THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

(Affiliated with A.A.A.S.)

OFFICE OF THE EDITOR
ALABAMA, COLLEGE
MONTEVALLO, ALABAMA

VOLUME 30 JULY, 1958 NUMBER 1

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Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

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The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

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The Journal of the Alabama Academy of Science is published four times each year, in July, October, January, and April, and is sent without charge to all members of the Academy.

CONTENTS

FOREWORD

The *Journal* of the Alabama Academy of Science has appeared as an annual publication from the time of its beginning, Volume I in 1924-26, through Volume 29 in 1957. Beginning with Volume 30, the Academy Journal will appear as a quarterly publication, partially subsidized by financial support from the Alabama Polytechnic Institute, Auburn, Alabama. The Academy expresses its appreciation to Dr. Ralph B. Draughon, President of the Alabama Polytechnic Institute, for his interest in the Academy and for the support of A.P.I. for the *Journal.*

PRESIDENTIAL ADDRESS

Howard College

Birmingham, Alabama

APRIL 1-2, 1958

Survey of Science and Mathematics Offerings in Alabama High Schools

HOWARD CARR

Alabama Polytechnic Institute, Auburn, Alabama

In the summer of 1955 Dr. Paul Bailey, of Alabama College[1], made a survey of the training of high school science teachers employed in Alabama high schools. Since much interest is currently evidenced in the science and mathematics programs in the high schools of Alabama, a new survey was undertaken by the author in the spring of 1958. Among the reasons for making the survey were:

1. To ascertain the state of mathematics and science offerings in our high schools some three years after a rather deplorable state was revealed by Dr. Bailey's report.

2. To gather 1957-58 data from our Alabama high schools before the impact of the criticism of an aroused and somewhat disturbed public coupled with that from the press, radio, television, and many scientists had affected the usual science and mathematics offerings. A barrage of criticism, suggestions, and defenses of high school curricula has come in the wake of the Sputniks and Explorers. It is probable that the coming 1958-59 high school curricula and enrollments in these curricula will reflect evidence of the concern of the relative scientific position that the United States occupies in the society of nations. In order that any curricula and enrollment changes that should be attributed to the unrest arising from the success of the Russian scientists and engineers in the guided missile and satellite field be correctly assessed, data should be collected for the present school year. Many learned persons, particularly those in the humanities, already feel that educators in America are being stampeded into unreasonable and unjustified revisions of the material presented the youth in both high schools and colleges and they are fearful of the possible consequences of an overemphasis in the sciences. A follow-up survey made a year hence could reveal the

extent of any hurried changes that have resulted from the fear that survival and progress in America is in jeopardy.

3. Since the author is generally uninformed about the high school training programs in science and mathematics, he desired to collect his own data. The results of the survey are both comforting and disturbing—comforting to find some aspects of the high school programs corroborated an existing opinion, some even exceeding preconceived notions, but also disturbing in finding some phases of high school education farther afield than was reckoned previously.

Early this year a letter was mailed to all high school principals in our state, both Negro and white, requesting their cooperation in making a simple survey concerning the science and mathematics offerings in their schools. A questionnaire was enclosed that could be completed almost entirely by checking blanks designated Yes or No. Principals of schools from which no reply was received within two weeks were written a second time. By so doing excellent response was obtained from the schools, as Table I shows. The questionnaire did not request the signature of the respondent, but did request the name of the high school. In order that data from the Negro and white schools be kept separate, the questionnaire sent to the Negro principals had the lower left corner just perceptibly clipped.

The first query on the questionnaire was designed to ascertain (1) if courses were currently taught in biology, chemistry, and physics, and/or (2) if they were taught in alternate years, as is so often the case with chemistry and physics, or (3) if these courses were taught when needed, i.e., when demanded by enough students. In the author's opinion, principals may conscientiously report that courses are offered "when needed" and yet these courses very seldom, if ever, are made available to the students. This condition was admitted by school administrators on quite a few questionnaires. The results from the first query are shown in Tables II, III, and IV where the percentage of the schools offering the courses are given for the Alabama High Schools for this 1957-58 academic year. Comparable data is shown for 1954-55 from the Bailey report and also for the United States as a whole for the 1956-57 year[2]. In biology Alabama exceeds the United States average, and it appears that the white Alabama high schools have increased their offerings from 56 per cent to 97 per cent in three years. However, the Bailey Report did not include a great number of high schools accredited by the Southern Association of Secondary Schools. Since these are the best secondary schools in the state, they would probably offer biology

every year and the per cent given in the Bailey Report is too low. Obviously the colleges and universities in our region with their many excellent and dedicated teachers have prepared a fine array of high school biology teachers. However, when these results are compared later to others given in the Bailey report, they furnish little basis for great optimism.

Table III summarizes the data collected in the field of chemistry. It is worthy of note to call attention to the fact that a significantly higher percentage of Negro high schools offer chemmistry every year than do white schools. Also note that chemistry is taught in alternate years predominantly in the white high schools of our state. There is no obvious explanation for this situation since it cannot be attributed to the relative enrollments of the white versus Negro high schools. Normally the smaller schools could be expected to offer science courses in alternate years, but Negro and white schools have about the same percentage of schools with low enrollments, i.e. 13 per cent of the white high schools have 100 or less students as compared to 15 per cent for the Negro schools. Also 42 per cent of the white high schools have 200 or less students as compared to 45 per cent for the Negro schools. While the Negro schools with small enrollments are more numerous relatively, the difference is too small and in the wrong direction to be significant in this argument. It appears that the white schools are simply following an old tradition which the Negroes have not recognized or have seen fit to ignore. Smaller student populations are not prohibiting the offering of acceptable and desired science and mathematics courses, and no support can be found for the continuance of the consolidation of the smaller high schools from these data. Note in Table III that data from the Bailey Report coincide with those from this survey, and note also that Alabama falls considerably behind the national average for chemistry offerings, being only one-half the national average for our white schools.

Table IV gives similar data for physics. What was noted for chemistry is applicable here also — the percentage of Negro schools offering physics every year exceeds that for the white schools and the percentage of white schools offering physics every year is about one-half the average in the States. There is one significant observation, however—physics offerings are the lowest of all the sciences.

Table V shows the percent of high school students presently enrolled in the sciences in Alabama. These data were computed from science class enrollment figures obtained from the question-

naire and from total high school student enrollment in classes nine through 12 as obtained from the State Department of Education.

Data given in Table V show that:

(1) Negro students exceed white in all cases.
(2) The percentage of Alabama high school students taking science is about the national average—even exceeds the U. S. average for chemistry and physics.
(3) Physics is lowest of the three sciences.

The lowly position for physics is not strange to most physicists for such has been the state of events for the last four decades during which time most scientists first became interested in high school work. However, before 1922, the percentage of students in physics led all those in the high schools in the United States.

The next questions submitted to the high school principals sought data on:

1. Whether laboratory experiments were given in the science courses,
2. Whether in the opinion of the respondent (not necessarily the school principal) the laboratory facilities were adequate, and
3. Whether in the opinion of the respondent the instructional program was adequate.

One recognizes the danger of accepting the opinions of supervisors or participants in the high school science programs as to the adequacy or inadequacy of the laboratory facilities and the adequacy of the instructional program. However, there is, in the opinion of the author, a very definite need for the opinions from our high school administrators and teachers, for the cataloging of these opinions may shed some light on the status of the high school science programs.

Table VI summarizes the data gathered in the field of biology. Table II shows that almost 100 per cent of the high schools in the state offer biology to their students. Table VI shows that, for whites, 87 per cent of the biology classes have laboratory experiments associated therewith, and 38 per cent of the white high school classes are considered to have adequate laboratory facilities. Furthermore, 79 per cent of the schools are deemed to have an adequate instructional program. No quarrel exists with the opinions expressed concerning the laboratory equipment, but the author does have serious reservations concerning the adequacy of the science instruction as reported. The very nature of the questionnaire employed is perhaps responsible; for Table VI indicates a rather

optimistic view of the competency of the high school science staffs. Dr. Bailey considered those teachers who had earned 12 collegiate semester hours or more in biology as adequately trained in this field, and 50 per cent of the biology teachers employed in 1954-55 fell in this category. While Dr. Bailey's evaluation appears generous, it is conceded that 12 semester hours of collegiate work give a prospective teacher considerable command of his subject matter. If having completed a major or minor in biology is considered a measure of adequate preparation, the number of biology teachers employed in 1954-55 in the entire state who were well trained to teach this subject was, from the Bailey Report, 58. (It should be higher since not all the schools accredited by the Southern Association of Secondary Schools responded to the Bailey questionnaire). However, if this major or minor criterion is used, only 16 per cent have a competency gained by extensive and formal collegiate training. In 1955, 50 per cent of the biology teachers in the state had less than 12 semester hours in biology and 10 per cent had none. While the data presented in this paper is taken essentially three years later, there is no evidence to support a thesis that the preparation of our high school biology teachers has increased in any manner that would bring these percentages into substantial agreement. Although offerings in biology have increased about 40 per cent since 1955. sufficient reasons to warrant listing 79 per cent of our biology teachers as giving adequate instruction cannot be found. It is true that some biology teachers are self taught to an acceptable level, but these teachers are rare persons. A similar discrepency shows up in the next two tables.

Table VII summarizes similar data for chemistry. Dr. Bailey again considered those teachers with 12 or more semester hours in chemistry adequately trained. And again in 1955, 50 per cent of the chemistry had less than 12 semester hours in chemistry, eight per cent had none. Only seven per cent of the chemistry teachers employed had completed a major or minor in chemistry.

Table VIII gives kindred figures for physics. In 1955, 60 per cent of the physics teachers in the high schools had less than six semester hours of college physics, and 40 per cent had none. Indeed only three teachers in the entire state had a major in physics and only one, a minor. Or put another way, only one per cent of the science teachers were really well prepared in physics. These data indicate that many of our school administrators or science teachers have not judged critically the level of the high school science programs, and have been optimistic in accepting any science course

taught under difficult conditions as being adequately done. Knowing the severe handicap under which high school science programs operate, this judgement can be appreciated, but hardly accepted. No one, objectively looking over the high school science programs in the state, can accept the thesis that three-fourts of the biology and chemistry teachers are well trained (no matter how the training was obtained), and that two-thirds of the physics teachers are likewise giving adequate instruction. After a long dry spell of poor science work in the high schools it appears that a light shower of scientific teaching effort is taken as adequate relief. This lack of critical judgment is more serious than the obvious lack of sufficient laboratory equipment. The laboratory equipment deficiency would not be as serious, in many respects, for a well trained teacher as for a poorly prepared one. Ingenuity and resourcefulness of the better trained science teachers can, and will, overcome much of the difficulties arising from the paucity of equipment. The need of adequate laboratory facilities can possibly be relieved by having more funds allotted the schools, but a qualified teacher will not be had if the administrators accept the present efforts of science teachers as adequate. In this area of better informing our school administrators and the public as well, much missionary work needs to be done if we are to make significant progress soon.

Table IX shows some of the results of the questionnaire grouped in the three scientific fields and presented a bit differently. The figures given here are the percentages of the high schools in our state (compared to the total number in Alabama) that have been judged to have adequate laboratory and instructional programs. Note again the nadir position of physics.

Table X shows the variation of the percent of high school students enrolled in the three sciences during the last five decades.

Please note the:

1. very marked increase in the percentage of students taking biology
2. apparent leveling of the percentage in chemistry
3. the steady decrease in physics.

Since 1910 the high school population has grown about 13 times, so about 13 times as many students are taking chemistry now as then, about 300 times as many in biology, but only about four times as many taking physics. This may seem adequate to some but as of last year Research and Development became the No. 1 business in America, and domestic needs in scientific manpower cannot be ful-

filled with the present production of trained personnel, much less leave a surplus to export, and this is a necessity if America is to win the cold war.

The questionnaire also sought information on the offerings of Advanced Algebra, Plane Geometry, Solid Geometry, and Trigonometry in our high schools. Table XI shows the percentage of Alabama high schools who report that they are offering these courses now, or whenever a need arises. It is perhaps noteworthy to point out that the percentage of white schools offering the advanced mathematics course exceeds the national average in all except trigonometry, while the Negro schools show a marked deficiency only in Solid Geometry and Trigonometry.

Table XII shows the general decline in the percent of high school students taking advanced mathematics courses in the United States during the last five decades. Noting that the percentage of students taking physics and mathematics has declined steadily, we can surmise that a positive correlation exists between the two. Those students who avoid higher mathematics in high school cannot possibly succeed in high school physics, and later will be excluded from science and engineering curricula in our institutions of higher learning.

In summary the following observations seem pertinent:

1. The percentage of high school students taking science courses in Alabama is roughly the national average.
2. A significantly greater percentage of Negro children take high school science courses than white.
3. In three years the number of Alabama high schools offering biology has increased 40 per cent.
4. A more realistic appraisal of the adequacy of instructional programs in science should be made by school administrators.
5. Only 30 per cent of the students in the white high schools take an advanced science course within any one year.

The author wishes to acknowledge the assistance of Miss Marita Garin in the clerical duties associated with the survey and for the considerable aid given in tabulating the results. The author is also indebted to Dr. G. W. Smith of the State Department of Education for his assistance in obtaining some of the data presented in this paper.

LITERATURE CITED

1. Paul Bailey, Journal of Alabama Academy of Science, Vol. 28, pp 21-26.
2. Pamphlet 120, U. S. Department of Health, Education and Welfare.

TABLE I

High Schools Reporting

	White	Negro
Number of high schools in state	357	192
Number of high schools returning questionnaire	344	162
% of schools submitting data	96%	84%

TABLE II

High Schools Teaching Biology, 1957-58

	Alabama			
	Negro	**White**	**Bailey*[1]** (1955-56)	**U.S.[2]** (1956-57)
Currently offered	96%	97%	56%	90%
Offered on alternate years	4%	0		
Offered when needed	0	2%		

*The Bailey report covered the white high schools only.

TABLE III

High Schools Teaching Chemistry, 1957-58

	Alabama			
	Negro	**White**	**Bailey*[1]** (1955-56)	**U.S.[2]** (1956-57)
Currently offered	52%	34%	34%	64%
Offered on alternate years	26	57		
Offered when needed	3	4		

TABLE IV

High Schools Teaching Physics, 1957-58

	Alabama			
	Negro	**White**	**Bailey*[1]** (1955-56)	**U.S.** (1956-57)
Currently offered	39%	28%	30%	57%
Offered on alternate years	30	57		
Offered when needed	3	5		

TABLE V

Students Taking Science Courses in High Schools, 1957-58

	Alabama Negro	Alabama White	U.S.[2] (1956-57)
Biology	26%	17%	21%
Chemistry	13	7	8
Physics	9	5	4
An advanced science	48%	29%	33%

TABLE VI

Alabama High Schools Offering a Course in Biology, 1957-58, With Adequate Laboratory and Instruction

	Negro	White	Bailey*[1] (1955-56)
With laboratory	68%	87%	
With adequate laboratory**	23%	38%	
With adequate instruction**	62%	79%	50%

**As judged by respondent from high school, similarly for chemistry and physics.

TABLE VII

% of Chemistry Classes in Alabama High Schools, 1957-58, With Adequate Laboratory and Instruction

	Negro	White	Bailey*[1] (1955-56)
With laboratory	71%	83%	
With adequate laboratory	27%	44%	
With adequate instruction	59%	74%	50%

TABLE VIII

% of Physics Classes in Alabama High Schools, 1957-58, With Adequate Laboratory and Instruction

	Negro	White	Bailey*[1] (1955-56)
With laboratory	61%	78%	
With adequate laboratory	20%	31%	
With adequate instruction	50%	66%	40%

TABLE IX

% of Total Alabama High Schools Reporting with Indications of Adequate Laboratory and Adequate Instruction in the Sciences

	Biol.		Chem.		Phys.	
	W	N	W	N	W	N
% of total with adequate laboratory	33%	15%	35%	16%	22%	9%
% of total with adequate instruction	70%	62%	70%	48%	59%	36%

TABLE X

% of All High School Students in the U. S. Enrolled in Science Courses[2]

	1910	1934	1956
Biology	1%	15%	21%
Chemistry	7%	8%	8%
Physics	15%	6%	4%

TABLE XI

% of High Schools Offering Advanced Mathematics Courses, 1957-58

	Alabama		
	Negro	**White**	**U.S.[2] (1956-57)**
Advanced Algebra	69%	84%	63%
Plane Geometry	77%	88%	81%
Solid Geometry	11%	34%	27%
Trigonometry	9%	29%	33%

TABLE XII

% of U. S. Pupils in Advanced Mathematics Courses[2] (last 4 years of high school)

	1910	1934	1952	1956
Algebra	57%	30%	25%	29%
Geometry	31	17	12	14
Trigonometry	2	1	2	3

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PROGRAM

THIRTY-FIFTH

ANNUAL MEETING

of the

Alabama Academy of Science

April 1-2, 1958

HOWARD COLLEGE

Birmingham, Alabama

General Program

Monday, March 31, 1958

6:30 P.M.—Informal Dinner for Executive Committee, College Cafeteria

8:00 P.M.—Executive Committee Open Meeting, Room 203, Ingalls Hall

Tuesday, April 1, 1958

8:00 A.M.—Registration—Foyer, Ingalls Hall

9:00 A.M.—General Session—Room 203, Ingalls Hall
Howard E. Carr, Presiding Officer
Welcome, Harwell G. Davis, President, Howard College
Announcements—Herbert A. McCullough

10:00 A.M.—Section Meetings
I. Biological Sciences, Room 203, Ingalls Hall
II. Chemistry, Room 305, Ingalls Hall
III. Geology and Anthropology, Room 307, Ingalls Hall
IV. Forestry, Geography, and Conservation, Room 109, Ingalls Hall
V. Physics and Mathematics, Room 201, Ingalls Hall
VI. Industry and Economics
VII. Science Education, Room 210, Biology Building
VIII. The Social Sciences, Room 303, Ingalls Hall
IX. Medical Sciences, Room 201, Biology Building

12:30 P.M.—Lunch—College Cafeteria

2:00 P.M.—4:00 P.M.—Joint meeting with Junior Academy for Discussion of High School Science in Alabama, Library Assembly Room

Pupils .... Marvin Uphaus
McGill Institute
Homer Thompson
C. F. Vigor High School

Teacher .... Dorothy Ellison
Dora High School

Teachers' Teacher .... W. T. Wilks
Troy State Teachers College

Teachers' Supervisor .... J. C. Blair
State Department of Education

Inheritor of Pupils .... Frank J. Stevens
Chemistry Department, API

Round Table

4:00 P.M.—Inspection of Junior Academy Exhibits, Rooms 103 and 109, Biology Building

4:30 P.M.—5:30 P.M.—Informal Tea for Members and Guests—Lounge, Women's Dormitory

7:00 P.M.—Annual Dinner—Lounge, Student Activity Building
Host: E. H. Sargent and Company,
Birmingham Division

PROGRAM

Invocation
Appreciations .... Herbert A. McCullough
Musical Program .... Music Department, Howard College
Presidential Remarks .... Howard E. Carr

Wednesday, April 2, 1958

7:45 A.M.—Breakfast—College Cafeteria

9:00 A.M.—12:00 Noon—Display of Exhibits, Alabama Junior Academy of Science, Rooms 103 and 109, Biology Building

9:00 A.M.—Annual Business Meeting, Room 203, Ingalls Hall

10:00 A.M.—Section Meetings

I. Biological Sciences, Room 203, Ingalls Hall
IV. Forestry, Georgraphy, and Conservation, Room 109, Ingalls Hall
VIII. The Social Sciences, Room 303, Ingalls Hall
IX. Medical Sciences, Room 201, Biology Building

Gorgas Scholarship Foundation

Monday, March 31, 1958

Selection of Winners of Alabama State Science Talent Search for General Gorgas Scholarships.

5:00 P.M.—Demonstration of exhibits to judges—Room 103, Biology Building

6:30 P.M.—Banquet for finalists and judges—College Cafeteria

8:00 P.M.—Personal interviews of finalists with judges — Biology Building

Alabama Junior Academy of Science

Tuesday, April 1, 1958

9:00 A.M.-12:00 Noon—Registration of members and of exhibits and papers—Lounge, College Cafeteria

10:00 A.M.-12:00 Noon—Preparation of exhibits—Rooms 103 and 109, Biology Building

10:30 A.M.—A. Caucus of officers and official delegates, Pharmacy Building

B. Conference of sponsors and AJAS Counselor, Pharmacy Building

12:00 Noon—Lunch—College Cafeteria

1:00 P.M.—Business meeting—Library Assembly Room

2:00 P.M.—A Joint meeting with Senior Academy—Library Assembly Room

B. Tours

4:00 P.M.—Judging of exhibits (Exhibits closed during judging.) (Students responsible for explaining exhibit must be present throughout judging.)

7:00 P.M.—Annual Banquet—College Cafeteria. Address by retiring president Marvin Uphaus

Announcement of finalists in judging of scientific papers

Announcement of winners in Alabama State Science Talent Search, William M. Murray, Jr., Director, Southern Research Institute

9:00 P.M.—Party—College Cafeteria

Wednesday, April 2, 1958

8:00 A.M.-12:00 Noon—Display of exhibits—Rooms 103 and 109, Biology Building

9:00 A.M.—Presentation of papers—Library Assembly Room

10:00 A.M.—Business meeting—Library Assembly Room

Election of officers for 1958-59

Treasurer's Report

Presentation of Alabama Academy Award

Presentation of awards for papers and for exhibits

Presentation of AAAS Awards

12:00 Noon—Adjournment

12:30 P.M.—"Dutch treat" luncheon—Old and new Executive Committees and sponsors.

Section Meetings

10:00 a.m. Tuesday, April 1, 1958

SECTION I, BIOLOGICAL SCIENCES

Gid E. Nelson, Jr., Chairman

Room 203, Ingalls Hall

1. **Some New Monogenetic Trematodes from the Gizzard Shad, DOROSOMA CEPEDINUM**
   Emmett W. Price, Jacksonville State Teachers College.
2. **Factors Affecting the Response of ZEA MAYS to Sodium 2,2-Dichloropropionate.**
   H. H. Funderburk, Jr., Alabama Polytechnic Institute.
3. **Studies on the Absorption and Translocation of Radioactive Simazin in Cotton, Corn, and Cucumbers.**
   Norman G. Sansing, Alabama Polytechnic Institute.
4. **Ecological Observations on the Imported Fire Ant, SOLENOPSIS SAEVISSIMA RICHTERI Forel, in Alabama.**
   Kirby L. Hays, Alabama Polytechnic Institute.
5. **Winter Annuals.**
   Roland M. Harper, University of Alabama.
6. **Comparative Effects of Epinephrine and Norepinephrine on Peripheral Blood Cells of the White Rat.**
   Styles Dean and Kenneth Ottis, Alabama Polytechnic Institute.
7. **Splenic Weight and Blood Flow Changes with Adrenergic Stimulation.**
   Kenneth Ottis, Alabama Polytechnic Institute.
8. **Fungi Associated with Diseased Pine Seedlings in Alabama Forest Nurseries.**
   William H. Padgett, Alabama Polytechnic Institute.
9. **Galactose Utilization in Yeast and Other Fungi.**
   G. Leon Howell, University of Alabama.
10. **Business Meeting.**

SECTION II, CHEMISTRY

Frank J. Stevens, Chairman

Room 305, Ingalls Hall

1. **The Effect of the Alkali Elements and Hydronium Iron as Extraneous Elements on the Flame Spectra of Alkali Elements.**
   E. L. Grove and C. W. Scott, University of Alabama.
2. **Entralpy-Concentration Diagram System Uranyl Sulfate-Water.**

L. G. Snow and R. E. Wingard, Alabama Polytechnic Institute.

3. **The Electronegativities of the Group Va Elements.**
   James E. Land, Alabama Polytechnic Institute.
4. **A Study of the Gallic Acid Complexes of Niobium, Tantalum, Titanium and Iron.**
   Lodric Maddox, E. L. Grove, and J. L. Kassner, University of Alabama.
5. **The Determination of Hyaluronic Acid in Synovial Fluid.**
   Mary Grace Blair, University of Alabama Medical and Dental Schools.
6. **Syntheses in the Quinoline Series: Some Derivatives of 6-Chloro-8-Ethylquinoline.**
   R. H. Crawford and J. D. Capps, Alabama Polytechnic Institute.
7. **Variation of Dielectric Constants with Temperature for some Five and Six Carbon Ketones.**
   G. E. Walden, E. L. Grove, and D. F. Smith, University of Alabama.
8. **Business Meeting.**

SECTION III, GEOLOGY AND ANTHROPOLOGY
Wiley S. Rogers, Chairman
Room 307, Ingalls Hall

1. **Geologic Research in Alabama.**
   Earl L. Hastings, Geological Survey of Alabama.
2. **Origin of Faulting in the Birmingham Red Iron Ore District.**
   Thomas Simpson, U. S. Geological Survey.
3. **Some Implications of the Chickamauga Group.**
   Wiley S. Rogers, Birmingham-Southern College.
4. **The Formation of Pyrite or Marcasite in Recent or Late Geologic Time.**
   Hugh D. Pallister, Geological Survey of Alabama.
5. **The Relation of Oxidation Rates to Nitric Acid Concentration for some Bituminous Coals and a Lignite.**
   Reynold Q. Shotts, University of Alabama.
6. **Possible Origin of the Barite Deposits at Centerville, Alabama.**
   Steve DuChock, Birmingham-Southern College.
7. **Business Meeting.**

SECTION IV, FORESTRY, GEOGRAPHY, AND CONSERVATION
Thomas C. Croker, Jr., Chairman
Room 109, Ingalls Hall

1. **Southwest Alabama: A Geographical View.**
   J. Allen Tower, Birmingham-Southern College.

2. **Timber Resources of the Southwest Alabama Forest Empire.**
   Jake Stauffer, Alabama Division of Forestry, Dept. of Conservation.
3. **Role of the Pulp and Paper Industry in the Southwest Alabama Forest Empire.**
   Harry M. Roller, Jr., International Paper Co.
4. **From Palisades to Satellites: Lumbering, Poling and Piling in the Southwest Alabama Forest Empire From 1500 to 1957.**
   M. C. Leach, Alger Tenants in Common.
5. **Business Meeting.**

SECTION V, PHYSICS AND MATHEMATICS

Eric Rodgers, Chairman
Room 201, Ingalls Hall

1. **Physics and Textiles.**
   John Miles, Chemstrand Corp. and Athens College.
2. **Graphical Constructions for Simple Lens Image Location.**
   E. Scott Barr, University of Alabama.
3. **The Effects of Inhomogeneous Compression on the Nuclear Quadrupole Resonance of NaC103.**
   D. L. Hollis, University of Alabama.
4. **The Effect of Temperature on Photomultiplier Response.**
   John L. Rawls, Jr., Alabama Polytechnic Institute.
5. **A Model to Show Light Curves of Eclipsing Binaries for Elementary Astronomy Classes.**
   Herschell C. Doss and F. H. Mitchell, University of Alabama.
6. **Latin-American Mathematical Publications.**
   W. L. Furman, Spring Hill College.
7. **The Howard College Cyclotron.**
   W. H. Bancroft, Jr., Howard College.
8. **Suggestions for Experiments Designed to Measure the Absolute Velocity of the Earth.**
   Niels N. Engel, University of Alabama.
9. **Paramagnetic Resonance in X-irradiated Potassium Chlorate.**
   Albert Ray Hughes, University of Alabama.
10. **Business Meeting.**

SECTION VII, SCIENCE EDUCATION

Mrs. Blanche E. Dean, Chairman
Room 210, Biology Building

1. **The Science Work-Conference on Improving Science Teaching.**
   J. Clyde Blair, State Department of Education.

2. **Symposium: The Changing Curriculum to Meet the Challenge of Our Times.**
A. R. Meadows, State Superintendent of Education.
Houston Cole, President, Jacksonville State Teachers College.
John R. McClure, Dean, College of Education, University of Alabama.
E. E. Sechriest, Principal, Ensley High School.
Question Period.
3. **The Conservation Council of Alabama.**
Mrs. Blanche E. Dean.
4. **Vital Problems of Conservation Facing Alabama Leaders Today.**
Jerry Bryan, The Birmingham News.
Question Period.
5. **Evidence of Abiotic Oxygen Uptake by Sediments of the Sea.**
Frank W. Eller, Indian Springs School.
6. **Business Meeting.**

SECTION VIII, THE SOCIAL SCIENCES
Robert E. Garren, Chairman
Room 303, Ingalls Hall

1. **Early Marriage of Students.**
Roland M. Harper, Geological Survey of Alabama.
2. **The Ride that Saved a City.**
George V. Irons, Howard College.
3. **An Amendment to Van Gennep's Analysis of Rites of Passage.**
A. T. Hansen, University of Alabama.
4. **A Study of Factors Associated with Brain-Damaged Children.**
Sylvia L. Hughes, Alabama Polytechnic Institute.
5. **Birth Control Practices in Selected Roman Catholic Countries.**
Russell L. Bliss, Alabama Polytechnic Institute.
6. **Business Meeting.**

SECTION IX, MEDICAL SCIENCES
S. B. Barker, Chairman
Tuesday, 10 a. m., April 1, 1958

1. **Jerome Cochran: Guiding Genius in Public Health Legislation.**
Emmett B. Carmichael, University of Alabama Medical Center.
2. **The Change from Logarithmic to Logistic Growth.**
William J. Wingo, University of Alabama Medical Center.
3. **Tissue Reaction to Various Arterial Grafts.**
W. Sterling Edwards, University of Alabama Medical Center.

4. **Factors Affecting Blood Oxidation—Reduction Potentials.**
True W. Robinson, University of Alabama Medical Center.
5. **Action of Desalting by Electrodialysis on Thyroxine and Other Iodinated Compounds.**
Nicole Etling and S. B. Barker, University of Alabama Medical Center.
6. **Micromethods for Assay of L-Glutamic Acid Dehydrogenase and D-Amino Acid Oxidase in Animal Tissues.**
Wynelle D. Thompson and William J. Wingo, University of Alabama Medical Center.
7. **Assay of Pituitary Melanophore Hormone by a Reflectance Technique.**
Jane Reid Patton and Robert S. Teague, University of Alabama Medical Center.
8. **Variation in Mineral Metabolism among Subjects Receiving a Constant Intake.**
Frieda L. Meyer, University of Alabama.
9. **Effect of Therapeutic Doses of Salicylates on Adrenal Cortical Secretory Activity in Normal Subjects.**
Mattie C. Gautney, Alexander Ulloa, Howard L. Holley, Gertrude B. Myer and S. Richardson Hill, Jr., University of Alabama Medical Center and Birmingham V. A. Hospital.
10. **Business Meeting, Medical Sciences Section.**

Wednesday, 10:00 a.m., April 2, 1958

SECTION I, BIOLOGICAL SCIENCES

Gid E. Nelson, Jr., Chairman

1. **Natural History and Distribution of Water Mites, Genius Unionicola, in ANODONTA GRANDIS Say, LAMPSILIS SILIQUOIDA (Barnes), and LIGUMIA NASUTA (Say).**
Paul Nakana, Huntingdon College.
2. **Control of Southern Blight of Tomatoes and Peppers in Alabama**
Urban L. Diener, Alabama Polytechnic Institute.
3. **Relation of Mold to Deterioration in Stored Peanuts.**
Urban L. Diener, Alabama Polytechnic Institute.
4. **Some Cytological Observations in Onion Root Tips.**
Elizabeth Stewart, Alabama College.
5. **Observations on the Life History of the Triple-Tail, LOBOTES SURINAMENSIS (Family Lobotidae).**
Herbert Boschung, University of Alabama.

6. **Some Microbial Relationships and Antibiotic Effects Associated with SCLEROTIUM ROLFSII in TRIFOLIUM REPENS.**
   E. A. Curl and J. D. Hansen, Alabama Polytechnic Institute.
7. **Soil Microorganisms Associated with Naturally Occuring Sclerotia of Sclerotium Rolfsii and their Antibiotic Effects upon the Pathogen.**
   E. A. Curl, Alabama Polytechnic Institute.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION
Thomas C. Coker, Jr., Chairman
Room 109, Ingalls Hall

1. **Wildlife Resources in the Southwest Alabama Forest Empire.**
   Ralph H. Allen, Jr., State Game Management Section, Alabama Department of Conservation.
2. **Clearcutting Southern Pine in Alternate Strips in Combination with Shelterwood.**
   George T. Garin, Alabama Polytechnic Institute.

SECTION VIII, THE SOCIAL SCIENCES
Robert E. Garren, Chairman
Room 303, Ingalls Hall

1. **The Manufacturing Interest of Alabama Planters, 1810-1830.**
   Richard W. Griffin, Alabama Polytechnic Institute.
2. **Response of Managers in Agriculture to Price Changes.**
   E. D. Chastain and John E. Lee, Jr., Alabama Polytechnic Institute.
3. **Can Unions Organize Branch Plants in the South?**
   Ellsworth Steele and Sherwood McIntyre, Alabama Polytechnic Institute.
4. **A Working Paper in the Area: A Sociological Definition of the Nature of Religion.**
5. **Religion in the U.S.S.R.**
   Manfred C. Vernon, University of Alabama.
6. **Philosophical and Spiritual Sources which Help Define the Present-Day Ideology of Integration.**
   David W. Friedrichs, Alabama Polytechnic Institute.

SECTION IX, MEDICAL SCIENCES
S. B. Barker, Chairman

1. **Evaluation of Renal Function in Adrenalectomized Dogs.**
   Ruth S. Hare, University of Alabama Medical Center.
2. **Studies on Carbohydrate Metabolism of Kidney Tissue.**

Julian J. Sizemore, Jr., Roger W. Hanson and S. B. Barker, University of Alabama Medical Center.

3. **Effect of Pyridoxal Phosphate on Maintenance of Rat Kidney Cortex Oxygen Consumption.**
   R. H. Lindsay and S. B. Barker, University of Alabama Medical Center.

4. **Electrophoretic Studies of the Mucin Clot from Human Synovial Fluid.**
   Edgar Gramling, Ward Pigman, Howard Holley, and David Platt, University of Alabama Medical Center.

5. **Bovine Submaxillary Mucin.**
   Kazutosi Nisizawa and Ward Pigman, University of Alabama Medical Center.

6. **Preparation and Characterization of Bovine Sublingual Mucin.**
   Shigeru Tsuiki and Ward Pigman, University of Alabama Medical Center.

7. **Evaluation of Clinical Use of Newer Serological Diagnostic Procedures in Rheumatoid Arthritis.**
   Merry Lynne Hayes, Stanley W. Griffin, and Howard L. Holley, University of Alabama Medical Center.

8. **Application of "Latex Fixation" Test to Spinal Fluid of Patients with Rheumatoid Arthritis.**
   Willard R. Starnes, Betty J. Crain, Alexander Ulloa, and Howard L. Holley, University of Alabama Medical Center.

9. **Attempt to Identify the "Rheumatoid Factor" in Serum of Members of Families of Patients with Rheumatoid Arthritis.**
   Stanley W. Griffin, Merry Lynne Hayes, and Howard L. Holley, University of Alabama Medical Center.

10. **Problems in Locating the Site of Action of Vitamin C.**
    Mary Grace Blair and Howard L. Holley, University of Alabama Medical Center.

11. **Studies on Synovial Permeability Using Radioiodinated Human Serum Albumin. (Read by Title only.)**
    W. E. Martindale, W. L. Hawley, H. L. Holley and W. J. Wingo, Birmingham V. A. Hospital and University of Alabama Medical Center.

12. **D-Amino Acid Oxidase and L-Glutamic Acid Dehyrogenase Contents of Tetrahymena pyriformis Y at Two Phases of Growth. (Read by Title only.)**
    Wynelle D. Thompson and W. J. Wingo, University of Alabama Medical Center.

EXECUTIVE COMMITTEE MEETING

Room 112, Phillips Science Building
Birmingham-Southern College
Birmingham, Alabama, November 23, 1957

President Carr called the meeting to order at 10:00 a. m.

The following members were in attendance: Gibbes Patton, Samuel B. Barker, William J. Barrett, Herbert A. McCullough, Eric Rodgers, Fr. Patrick Yancey, Paul J. Arnold, Gid E. Nelson, Jr., Frank J. Stevens, F. L. Westover, Thomas C. Croker, John Baswell, Wiley S. Rogers, John Fincher, Howard Carr, Hoyt M. Kaylor, J. Allen Tower, Herbert A. Boschung, Paul Bailey, James Sulzby, Clyde Cantrell, and Henry Jennings.

Copies of the agenda for the meeting and copies of the minutes of the Executive Committee Meeting of April 24, 1957 were distributed. H. A. McCullough moved that the reading of the minutes be dispensed with and the minutes approved as mimeographed. Mr. Stevens seconded and the minutes were approved.

The combined Report of the Secretary, the Admission to Membership Committee was given (Copy attached) (Summary of report: The number of collegiate members who have been added since the last meeting is 28 and the number of individual members is 6. An accurate membership record will be compiled after finding the number of delinquent members.) Dr. Barrett moved approval of the report and upon a second by Dr. McCullough the report was approved.

The Report of the Treasurer was given by Dr. Barrett. (Copy attached) (Summary of report: General Fund has a balance of 593.77; the Research Fund, 403.24. The cost of printing of Journal has been paid. The total balance is 997.01). Dr. McCullough commented on the good financial status of the Academy. Mr. Baswell made favorable comment in regard to contacting delinquent members. Upon motion by Father Yancey and second by Dr. Patton, the report was approved.

The Report of the Editorial Board was given by Dr. Westover. (Copy attached) (Summary of report: Board cooperated with Journal Editor, advising him on problems concerning the publication of Journal and reviewing papers submitted to the Editor for publication). With no discussion, it was moved by Herbert McCullough and seconded by Bill Barrett that the report be accepted. The report was approved.

There was no report of the Research Committee.

The Report of the Membership Committee was made by Dr.

McCullough. (Copy attached) (Summary of report: Contact has been made of all committee members requesting them to contact all members of their sections and their acquaintance who are eligible for membership in the Academy. All members of AAAS residing in Alabama who are not members of the Academy are to be contacted and invited to join.) Dr. Rodgers moved, Father Yancey seconded, and the report was approved.

The Interim Report of Long-Range Planning Committee was given by Dr. Fincher. (Copy attached) (Summary of report: Report consisted of four major recommendations: (1) President and President-elect make a special effort to have a symposium each year on some specific Alabama resource or possibly history of science or social aspects of science. (2) Academy appoint annual committee to study possibilities and handle all publicity of each annual meeting. (3) The Academy appoint a committee to study ways and means of collaborating with agencies and foundations that sponsor workshops in science teaching and in encouragement of science careers, in an effort to meet specific needs of State of Alabama in regard to shortage of scientists and science teachers. (4) Academy establish several committees to function as auditors in studying science education perhaps in three fields: (a) elementary, (b) secondary, (c) undergraduate and graduate. (5) The committee is interested in possibility of having presentation of paper of more interest to collegiate members who attend annual meetings.)

Discussion of the report was point by point. It was pointed out by Dr. McCullough that the program was prepared by the president and that the president should be given the privilege of setting symposia. The topic field should be flexible enough to take advantage of current interests. With substitution of "president and president-elect" for "Program Committee," Dr. McCullough moved, Dr. Barker seconded and approval of point (1) was given.

In regard to point (2) it was pointed out that the Academy has a Public Relations Committee. Mr. Baswell stated his committee would welcome ideas for publicity and could handle publicity for annual meeting. Father Yancey noted that most effective means would be for one man who is well qualified and can get material into daily newspapers to handle publicity.

MOTION: By Dr. Barker, seconded by Dr. Patton.
Second point of report of Long-Range Planning Committee be turned over to Public Relations Committee, taking cognizance of Father Yancey's suggestion concerning newspaper.
Discussion: Dr. McCullough stated that publicity need not be

confined to the annual meeting. A series of articles in the newspapers to acquaint the public with the purposes and functions of the academy would be excellent publicity for the Academy. It would be well to do this sort of thing now in order to take advantage of the current popular interest in science since the advent of "Sputnik." Mr. Baswell noted that weekly papers have large coverage and articles in them as well as in the dailies would be valuable. Dr. Barker suggested Steve Yates and Miss Hollyman as possibilities for writing such a series. Motion passed. President Carr asked if the recommendations of point (3) did not fall in the province of the Science Education Committee. Dr. Fincher answered to the affirmative.

MOTION: By Dr. Rogers, seconded by Dr. Barrett, point (3) is to be handled by Science Education Committee. Motion passed. MOTION: By Dr. McCullough, seconded by Dr. Arnold.

Point (4) also be referred to Science Education Committee with the committee being enlarged if necessary to handle the work. Dr. Westover asked if secondary included undergraduate in its scope. President Carr pointed out that there has been established an Education Study Commission in the state which covers item (4). He suggested that the Science Education Committee of the Academy make known its interest in their work and offer assistance in the science field. Dr. Tower suggested that President Carr write to the Education Study Commission and offer the services of the Science Education Committee to the Commission. Mr. Baswell stated that the offer of aid should not be all the Academy does in this field, but the academy should work also for improvement of curriculum and instructing of undergraduate curricula studies. Mr. Wiley Rogers pointed out that there is an overabundance of committees working in field and agreed with Dr. Stevens that adequate salaries would solve whole problem in time. Dr. Fincher offered to amend point (4) to include undergraduate in the statement of Long-Range Planning Committee. With the statement of point (4) amended. motion was passed.

Mr. Sulzby gave no formal Report of the Finance Committee, stating that the report would be included in the report of the Special Committee on the Journal. Mr. Jennings moved, Mr. Cantrell seconded, and report was approved.

There was no formal Report of the Editor of the Journal. Dr. Bailey said Volume 29 has been printed at a cost of 1404.27. Dr. Barker moved, Mr. Rogers seconded and approval of report was given.

Dr. Tower gave Report of Special Committee on the Journal. (Copy and correspondence of committee attached.) (Summary of report: Both Alabama College and API made offers for partially absorbing cost of printing Journal in form of a quarterly. Committee recommends: (I) Accept API offer for three years with renewal to come up after three years. (II) Retain services of Dr. Bailey as Editor). Dr. Tower moved acceptance of recommendation of the committee and Dr. McCullough seconded. Father Yancey and Mr. Sulzby commended work of committee and heartily endorsed keeping of present Editor, Dr. Bailey. Report was approved.

MOTION: By Dr. Barker, seconded by Mr. Baswell.

The Executive Committee express a vote of thanks to the Special Committee on the Journal and to its chairman for coming up with the proposal for publishing of the Journal. Motion passed.

There was no formal Report of Councilor of AAAS. (Summary of report: Nothing has occurred to be added to spring report. AAAS meets next in Indianapolis. The National Science Foundation is willing to put a full-time man in area for science education study.) Upon a motion by Dr. Tower, and a second by Dr. Fincher, the report was approved.

Dr. Gibbes Patton gave the Report of the Committee on the Junior Academy. (Copy attached) (Summary of report: Committee recommends: (1) President of AAS supervise search for a Permanent Counselor for AJAS with Associate Counselor positions to be filled annually. (2) Academy seek funds to pay at least travel expenses of this Permanent Counselor to AJAS. (3) In lieu of immediate Permanent Counselor, Academy fill immediately position of Associate Counselor now vacant and name successor to present Counselor whose term expires in 1958. (4) Academy include in its budget a Junior Academy Fund sufficient to at least cover cost of awards by Senior Academy to Junior Academy members.)

MOTION: Dr. Patten moved and Father Yancey seconded adoption of recommendation of committee in regard to obtaining Permanent Counselor. Motion approved.

MOTION: Dr. Patten, seconded by Dr. Barker.

Recommendations regarding inclusion in Senior Academy Budget of Junior Academy Fund be approved. Substitute motion by Dr. McCullough. Finance Committee of Senior Academy be charged with investigation of the needs of AJAS. Dr. Patton withdrew original motion and seconded the substitute motion. Substitute motion approved.

MOTION: Dr. Patton, seconded by Father Yancey.

Recommendation for immediate appointment by Academy of Associate Counselor and naming of successor to Counselor be approved.

SUBSTITUTE MOTION: Dr. Tower, seconded by Mr. Baswell.

President of Academy in consultation with Steering Committee resolve the dilemma concerning counselors for AJAS. Upon withdrawal of original motion substitute motion was approved.

The Report of the Coordinator of Science Fairs was read by the Secretary. (Copy attached) (Summary of report: Regional Fair Program continues with four operating fairs annually. Problem of federal income tax exemption is one prime concern.) Dr. Tower moved that the report be accepted. Upon second by Dr. Barker and a vote of members, the report was accepted.

Dr. Stevens gave an informal Report of the Science Education Commiteee. (Summary of report: No formal meetings have been held. Correspondence between members has been used to fulfill the functions of the committee. The committee is active in the sponsorship of science workshops for teachers.) Dr. Arnold moved and Dr. McCullough seconded the approval of the report. Report was approved.

Dr. Boschung, Editor of Academy Newsletter, reported that newsletter in hands of Secretary for mailing and that Dr. Henry Walker, head of the Department of Biology at the University, has agreed for his department to absorb cost of the paper used for the newsletter. Upon motion of Dr. Barker, with Dr. Barrett seconding, the report was approved.

Mr. Baswell verbally stated Report of Public Relations Committee was essentially given in discussion regarding Report of Long-Range Planning Committee. The Public Relations Committee would seek to carry out this recommendation. Upon motion by Dr. Nelson and seconded by Mr. Sulzby report was approved.

MOTION: By Dr. Barker, seconded by Dr. Westover.

The Academy has a statement in its by-laws in regard to who shall receive a copy of the Journal. Motion passed.

The Report of Historical Committee was given by Mr. Cantrell. (Copy attached) (Summary of report: The history of the Academy is very nearly completed and under favorable circumstances will be completed by end of year 1957.) Mr. Sulzby moved the acceptance of the report. Upon a second by Dr. Bailey and a vote of the members, the report was approved.

The Reports of Committee on Place and Date of Meeting and Local Arrangements Committee given by Dr. Arnold and Dr. McCullough respectively. Dr. Arnold moved acceptance of invitation of Alabama Polytechnic Institute to meet on their campus in 1959. Upon a second by Mr. Sulzby and vote of members, motion carried. The 1958 meeting date with Howard College as host must be during week of March 29 through April 6, 1958. After discussion, and upon motion by Father Yancey and a second by Dr. Barker, the members voted the date of the 1958 meeting to be March 31, April 1, April 2, 1958. Those dates are on Monday, Tuesday, and Wednesday, respectively. Motion was passed.

The President called for New Business.

1. President Carr reported that the perennial sponsor of the banquet at the annual meeting, E. H. Sargent, has withdrawn its sponsorship. He is now exploring the possibilities of a financial sponsor and would appreciate any notes or any suggestions concerning such a sponsor.

2. President Carr reported that the tax status of the Academy is not yet clarified. Before donations to the AAS can be tax-free legally, it is necessary to know what dispensation is to be made of the funds and property of the Academy should it be dissolved.

MOTION: By Dr. Tower, Seconded by Mr. Sulzby.
The president and the Steering Committee prepare an amendment regarding dispensation of the property and funds of the Academy, and present this amendment at the next meeting of the Executive Committee and to the membership of the Academy. Motion passed.

3. MOTION: By Mr. Croker, Seconded by Dr. Tower.
Section IV passed a resolution at annual meeting to ask Executive Committee to change the name of Section IV in the By-Laws from "Geography and Conservation" to "Forestry, Geography, and Conservation." Motion passed.

4. MOTION: By Mr. Rogers, seconded by Mr. Cantrell.
The Finance Committee study collegiate membership in regard to finances. Motion passed.
Upon a motion by Mr. Jennings and numerous seconds, Dr. Carr declared the meeting adjourned.

Respectfully submitted,
Hoyt M. Kaylor
Secretary

EXECUTIVE COMMITTEE MEETING

Room 203, Ingalls Hall, Howard College
Birmingham, Alabama, March 31, 1958

President Howard E. Carr called the meeting to order at 8 p.m.

The following members were introduced by the Secretary: Howard Carr, John Fincher, Herbert A. McCullough, William Barrett, Eric Rodgers, Alan Hisey, J. Allen Tower, Paul Arnold, Wiley Rogers, Paul Bailey, Gid Nelson, Blanche Dean, F. L. Westover, John Baswell, A. T. Hansen, Frank Stevens, John Sulzby, Clyde Cantrell, Robert Garren, Patrick Yancey. Visitors and members arriving later were: W. T. Wilks, Gilbert Spencer, Herbert Boschung, Frank Soday, James Wilkes.

The minutes of the Executive Committee Meeting of November 23, 1957 were distributed. Dr. Tower moved the approval of the minutes as mimeographed. Dr. Rodgers seconded, and the minutes were approved.

The Report of the Secretary and the Admission-to-Membership Committee was given. (Copy attached) (Summary of report: The membership of the Academy is 594. Of those, 505 are individual members, 86 are collegiate members, and 13 are in categories of Fellows, Honorary, and Life members. There are new application blanks available. Deceased members are Mildred Johnson and Sister Mary Charles Daly.) Dr. Tower moved the approval of the report. Following a second by Dr. McCullough, the report was approved.

Dr. William Barrett gave the Report of the Treasurer. (Copy attached) (Summary of report: There is a balance of 1,830.49 in the General Fund; in the Research Fund, 493.24, giving a total balance of 2,323.73.) Dr. Arnold moved, Dr. Nelson seconded, and the report was approved.

Dr. Bailey gave a Combined Report of Editor of Journal and Editorial Board (Copy attached). (Summary of report: 1. The format should be changed to 6" x 9". 2. There will be four issues of each volume. (1) July 1—Proceedings, officers, minutes, etc. (2) October 1—Abstracts and full-length papers. (3) January 1—Abstracts, full-length papers, and membership list. (4) April 1—Full-length papers and index. 3. Members may submit papers for publication anytime during the year. The papers do not have to appear on the annual program. 4. The Editor and Editorial Board may ask

other members to review papers when they do not feel qualified to review them.) Dr. Rodgers moved that the report be approved as read. Dr. Hisey seconded. In the following discussion, it was asked if the Presidential Address of the Junior Academy might be included in the first issue. Dr. Bailey pointed out that the proposal of contents was for normal routine. Exceptions could be authorized by the Executive Committee. Upon call for question, the report was approved.

There was no Report of the Research Committee.

The Report of the Membership Committee was given by Dr. McCullough. (Summary of report: Letters were sent to all Alabama members of AAAS who were not members of the Academy, inviting them to join. The response has been good.) Dr. Bailey moved, Dr. Barrett seconded, and the members voted approval of the report.

There was no Report of the Long-Range Planning Committee.

Mr. Sulzby gave the Report of the Finance Committee. (Summary of report: After numerous consultations with various Academy Officers and members, it is the recommendation of the Finance Committee that collegiate members receive all issues of the Journal as part of their membership, even though the cost is greater than their dues payment. One way in which cost would be alleviated is to designate that all their dues go to allay cost of the Journal.)

MOTION: by Dr. Tower, seconded by Dr. McCullough.
The Academy will continue to fulfill its obligation to send the Journal to all student members. Motion passed.

Upon a motion by Mr. Rogers and a second by Father Yancey, approval of the report was voted.

The Report of the Councilor of the AAAS was given by Father Yancey. (Summary of report: Councilor attended the Indianapolis meeting. Membership in AAAS has increased by 3,300. The Journals of the AAAS have been merged. All past presidents of the AAAS are on the Council. Eight new Academies are now members of AAAS. Alabama Academy Councilor made the motion that AAAS representative of an Academy must report to his Academy.)

President Carr reported that at the Fall meeting of the Executive Committee the president was instructed to (1) seek a permanent counselor for the Junior Academy and (2) replace the associate counselor who had resigned. In compliance with these instructions, the following was reported: 1. Mr. Reuben Boozer will be the Counsellor of AJAS for 1958. 2. Gibbes Patton will remain as as-

sociate counselor. 3. Gid Nelson has accepted appointment as associate counselor and will become Counselor in 1959. 4. Dr. J. A. Southern, elected in 1957 as associate counselor, completes the number.

Dr. McCullough assumed the chairmanship for the discussion of President Carr's report. Mr. Sulzby seconded Dr. Tower's motion for approval and it was so voted.

The report of the Counselor of AJAS given by Dr. Gibbes Patton (copy attached) was in essence the same as that of Dr. Carr's. Father Yancey moved, Dr. Arnold seconded, and the members voted approval of the report.

There was no Report of the Coordinator of Science Fairs.

The Report of the Science Education Committee was given by Dr. Stevens. (Summary of report: The chairman of SE Committee favored the Academy backing a report which the Committee of English Teachers was to present to the State Education Commission in the near future. This report censures the course requirements necessary for the obtaining of teachers' certificates.) In the ensuing discussion, Drs. Westover and Wilks objected to the Academy taking such a stand, while Mrs. Dean and Mr. Rogers favored such a stand being taken.

MOTION: By Dr. Tower seconded by Fincher.

> The report of the Science Education Committee be modified to state that the SE Committee will use the hearing for the English Teachers to present its views in regard to the requirements for teachers certificates. Motion passed.

Dr. Tower moved and Mr. Baswell seconded the report of SE Committee be approved. The report was approved by vote of members.

Dr. Boschung gave the Report of the Editor of the Newsletter. (Summary of report: Dr. Roland Harper is at the meeting and expresses his regrets that he missed the Executive Committee meeting. The mailing list should be brought up to date since numerous errors exist. The editor only compiles material sent to him and requests that material for the Newsletter be mailed in.) Dr. McCullough moved and Mr. Cantrell seconded approval of the report, and it was so voted.

Mr. Baswell gave the Report of the Public Relations Committee, stating that more and better publicity is in need for the Academy. He would welcome suggestions as to how this should be carried out. Father Yancey noted that if some feature writer of a daily newspaper could be interested in the proceedings and aims of the Academy, then best results would be obtained. Dr. Hansen moved

and Dr. Wilkes seconded approval of the report. A vote of the members gave approval.

The Report of the Custodian and of the Historical Committee was given by Mr. Cantrell. (Summary of Report: The history of the Academy would be finished by June 1. President Carr is to write the introduction.) Dr. Westover moved and Father Yancey seconded approval of the report. Approval of the report was given by a vote of the members.

The Report of the Committee on Place and Date of Meeting was given by Dr. Arnold. (Copy attached) (Summary of report: The 1959 meeting will be held at Alabama Polytechnic Institute. The date has not been set as yet. No official invitation has been received for 1960. A possibility which might encourage the attendance of more secondary teachers would be the first part of AEA week.) Mrs. Dean moved, Dr. Nelson seconded, and the members gave approval of the report.

Dr. Carr called for New Business. Dr. Hansen of the Research Committee noted that the program carried student papers which were to be considered for student research awards, but that this committee had not seen the papers. He would like for the procedure to be clarified for such student papers. Dr. McCullough and Dr. Tower noted that there was in the minutes a definite procedure to be followed, and that it might be well to carry this in one of the Newsletters.

MOTION: By Mr. Sulzby seconded by Dr. Arnold.
Those papers which came to be considered in competition for the student research awards be so entered. Motion passed.

Dr. Carr reported the status at the present in regard to the Academy as a tax-exempt organization. An amended statement of the Articles of Incorporation of the Academy has been prepared by Mr. Henry Jennings.

MOTION: By Dr. Tower seconded by Father Yancey.
The Secretary shall present the proposed amendment of the Articles of Incorporation to the Annual Business Meeting for a vote. Motion approved.

Dr. Robert Garren was elevated to section chairman of Section VIII.

Dr. Carr declared meeting adjourned at 9:50 p. m.

Respectfully submitted,
Hoyt M. Kaylor
Secretary

ANNUAL BUSINESS MEETING

Room 203, Ingalls Hall, Howard College
Birmingham, Alabama, April 2, 1958

President Howard E. Carr called meeting to order at 9:05 a. m.

The minutes of the Jacksonville State Teachers College Meeting of April 27, 1957 were distributed in mimeographed form. Dr. Barker moved the acceptance of the minutes as mimeographed. Mr. Otis seconded and the minutes were approved.

The Secretary gave a summary of the actions of the Executive Committee meeting of March 31, 1958, followed by a brief Report of the Secretary. Dr. Bailey moved, Mrs. Dean seconded, and the members voted approval to the report.

The Treasurer's Report was given by Dr. Barrett. Upon a motion by Dr. Tower, a second by Dr. Nelson, the members voted and the report was approved.

The Report of the Councilor of the AAAS given by Father Yancey was approved, following a motion by Mr. Goetz, a second by Dr. Fincher, and a vote by the members.

The Report of the Auditing Committee for the Senior Academy was given by Mrs. Dean. The books were found to be in good order. Mrs. Dean moved the acceptance of the report. Dr. Arnold seconded and the report was approved.

President Carr reported that the audit of the Junior Academy for 1957 had been completed by Drs. Boschung and Bishop.

MOTION: By Dr. Barker seconded by Father Yancey.

The report of the auditing of the finances of the Junior Academy be brought up to date at the Fall meeting of the Executive Committee. Motion passed.

Father Yancey read the Report of the Nominating Committee.

President: Herbert A. McCullough   Pres.-Elect: Samuel B. Barker

Vice-Presidents and Section Chairmen	Vice-Chairmen
I. James Wilkes	I. Jack Brown
II. E. L. Grove	II. Kenneth M. Gordon
III. William Powell	III. Earl Hastings
IV. William E. Black	IV. David E. Hampe
V. L. P. Burton	V. R. E. Wheeler
VI. John Baswell	VI. John F. Sulzby, Jr.
VII. Paul J. Arnold	VII. Mrs. Lucille Lloyd
VIII. George V. Irons	VIII. E. C. Paustion
IX. Alan Hisey	IX. Thomas E. Hunt

Councilor to AAAS (3 year term): Father P. H. Yancey
Trustees (Terms to expire in 1961): Vance Miles, Jr., and James F. Sulzby, Jr.

Dr. Tower moved and Dr. Fincher seconded that the Secretary be authorized to cast a unanimous vote for the slate. Motion passed.

Dr. Arnold gave the Report of the Place and Date of Meeting Committee. The meeting in 1959 will be at Alabama Polytechnic Institute, with the date to be set at the Fall Executive Committee meeting. No other official invitation has been received for the 1960 meeting. The report was approved following the motion of Dr. Barker, the second of Dr. Hansen.

Dr. Tower gave the Report of the Resolutions Committee. (Copy attached). Following a motion by Dr. Tower, a second by Father Yancey, the report was approved by standing vote.

MOTION: By the Secretary, second by Dr. Barrett.
Article II, Section 8, of the Articles of Incorporation of the Alabama Academy of Science be amended to read as follows: Alabama Academy of Science shall not have any capital stock, shall not pursue any of its objects or purposes for pecuniary profit to any of its members, and no part of its net receipts shall inure to the benefit of any private share-holder or individual. In the event of the dissolution of the Alabama Academy of Science, its assets will be used in the furtherance of the objectives for which the Academy was organized.
Amendment passed.

President Carr reminded the members to leave their name tags at the registration desk and declared the meeting adjourned at 9:50 a. m.

Respectfully submitted.
Hoyt M. Kaylor
Secretary

RESOLUTIONS COMMITTEE REPORT

Your Resolutions Committee submits herewith the following resolutions:

1. Whereas the Alabama Academy of Science is successfully completing its thirty-fifth annual meeting, now therefore be it resolved:

   a. That the Academy expresses its appreciation to Howard College and to its president, Harwell G. Davis, for their hospitality;

   b. That special appreciation is expressed for the work of Herbert A. McCullough, John Southern, Alpha Epsilon Delta, the Tri-Beta Club, and their associates who have so effectively provided the local arrangements for both the Senior and the Junior Academies;

   c. That the gratitude of the Academy is expressed to the Birmingham Division of E. H. Sargent and Co. for their hospitality in providing the annual dinner.

2. Whereas during the past year death has deprived the Academy of the valued services of two of its members, now therefore be it resolved that the Academy express its sympathy to the families and friends of Sister Mary Charles Daly and Mrs. Mildred Johnson, and its appreciation of the loyal and valuable services which they gave to the Academy.

J. Allen Tower
Edwin O. Price

ALABAMA ACADEMY AWARD—1958

The Alabama Academy Award for 1958 was conferred upon Mrs. Lucille Lloyd of C. F. Vigor High School, Prichard, Alabama at the twenty-fourth annual convention of the Alabama Junior Academy of Science, held at Howard College, Birmingham on April 1-2, 1958. The award consists of a gold key accompanied by a certificate of citation. It is given annually by the Alabama Academy of Science for meritorious teaching of science in the state. The purpose of the award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students,

as evidenced by their sponsorship of science clubs active in the Alabama Junior Academy of Science.

Mrs. Lloyd has been sponsor of her science club almost continuously since 1944. Her club has a record of regular participation in the events of the annual Junior Academy convention. Not only has she been active as a club sponsor and as a teacher, but she has contributed largely to the increasing success of the Science Fair activity in the Mobile region, and she has supported the work of the Mobile Academy of Science. It is in recognition of her vigorous and steady support of these youth-centered activities that Mrs. Lloyd is presented with the 1958 Alabama Academy Award.

REPORT OF THE COUNCILOR OF THE AAAS, 1958

I attended the AAAS convention in Indianapolis, December 27-30. The first meeting of the Council was held on December 27 and the second on December 30. The main business transacted was:

1. New Officers: President—Wallace R. Brode; President-elect—Paul E. Klopsteg; Members of the Board of Directors—Thomas Park, William W. Rubey, and Mina S. Rees.

2. Membership increased by 3,300 during the year.

3. *Science* and *The Scientific Monthly* will be merged henceforth under the name of the former.

4. All past presidents will henceforth be members of the Council.

5. Eight new affiliates, including the Chicago, Rochester and Montana Academy of Science, were added.

6. Resolutions: 1) To approve the adoption of the Metric System.

2) To ask for the revision of the tax laws to allow deduction of money given to science and education.

3) To urge institutions of higher learning to offer subject matter courses in science and mathematics for secondary school teachers.

4) To continue and enlarge the Committee on the Social Aspects of Science (appointed at the Atlanta meeting on the motion of Dr. Ward Pigman) and to include social as well as physical sciences.

ACADEMY CONFERENCE

The Conference met on December 28. The program consisted of a business meeting in the morning, a panel discussion of the Implementation of the Recommendations of the Chicago Conference on Junior Academies in the afternoon, and the dinner in the evening. Actions taken were:

1. Recommendation that all academies publish a brochure containing its constitution, by-laws, procedures for meetings, projects, awards, etc., and circulate to all other academies.

2. Recommendation that all academies give full status as an academy officer and member of the Executive Committee to the representative to the AAAS, and that a report be required of him.

3. J. A. O'Keefe of the Washington Academy proposed that the Academy Conference make an award on a national level to the outstanding high school science teacher every year. No action taken.

4. New Officers: President—John A. Yarbrough, North Carolina Academy; President-elect—A. M. Winchester, Florida Academy; Secretary-Treasurer—John G. Arnold, Jr., New Orleans Academy; Archivist—Clinton L. Baker, Tennessee Academy.

From the panel discussion in the afternoon it appeared that nothing much had been done towards implementing the recommendations of the Chicago Conference. However, it was brought out that the National Science Foundation would consider proposals from individual academies for their junior academies.

Respectfully submitted,
P. H. Yancey, S. J.
Councillor to the AAAS

ALABAMA ACADEMY OF SCIENCE

STATEMENT OF ACCOUNT

March 20, 1958

Date of Last Audit: April 19, 1957

Bank Balance:		$ 2,323.73
General Fund:		
Balance as of 4/19/57	$ 1,709.47	
Deposits	1,740.00	
	3,449.47	
Less disbursements	1,618.98	
		1,830.49
Research Fund:		
Balance as of 4/19/57	$ 474.74	
Deposits	160.00	
	634.74	
Less disbursements	141.50	
		493.24
President's Special Fund:		
Balance as of 4/19/57	85.00	
Deposits	— —	
	85.00	
Less disbursements	85.00	
		2,323.73

(See following for list of disbursements)

Checked against receipts and disbursements
March 21, 1958

William J. Barrett, Treasurer
Alabama Academy of Science

Auditing Committee:
Blanche E. Dean
Wayne H. Finley

General Fund:

1957	Check No.		
4/23		Exchange Bank—service charge	$ .26
5/1	62	Elliott Addressograph Co.—tube of ink	1.58
5/14	65	DeArman Printing Co.—programs for annual meeting	61.80
5/20		Exchange Bank—service charge	1.30
5/23		Exchange Bank—service charge	.13
6/20	69	H. A. Kaylor—secretarial expense	50.00
7/18	71	Southern Research Institute—ledger	3.30
7/22		Exchange Bank—service charge	.26
10/24	73	Academy Conference, AAS—1957 contribution	5.00
10/28	74	Times Printing Co.—Vol. 29, Journal	1,404.27
1958			
2/6	75	Elliott Addressograph—repairs and supplies	14.28
2/12	76	Southern Research Institute—printing '58 stmts.	9.00
2/12	77	J. R. Moncus, Postmaster—600 3 cents stamps	18.00
3/19	78	H. M. Kaylor, secretarial expenses	50.00
			$ 1,619.18
		Less credit transferred from President's special fund	.20
		Total:	$ 1,618.98

Research Fund:

1957			
6/17	66	James R. Piper—student award	$ 25.00
6/17	67	S. F. Yeung—student award	25.00
6/26	70	Marie Smith—lettering 4 certificates at 50¢ ea.	2.00
7/31	72	Dr. William Alford—research grant	89.50
		Total	$ 141.50

President's Special Fund:

5/1	63	Lasseter Company—22 sheets of Zipatone	$ 11.43
5/1	64	Electric Blue Printing Co.—20 Ala. state maps	3.84
6/20	68	Graphic Photo Co.—maps	69.53
7/18		Transferred to General Fund	.20
		Total	$ 85.00

ALABAMA JUNIOR ACADEMY

OF SCIENCE

Proceedings

of

Twenty-Fourth Annual Meeting

HOWARD COLLEGE

Birmingham, Alabama

April 1-2, 1958

PRESIDENT'S ADDRESS

Space—The Nothingness We Will Conquer

MARVIN J. UPHAUS, JR.

McGill Institute
Mobile, Alabama
April 1, 1958

Reverend Fathers, Revered Religious, Members of the Alabama Senior Academy of Science, Fellow Members of the Alabama Junior Academy of Science, Fellow Officers of the same Academy, Devoted Teachers, Distinguished Speakers and Guests:

A year ago I gloried in the honor granted to me and my school when I became President of the Alabama Junior Academy of Science. Even then I saw tonight with some sense of awe when I knew that I would be called upon to deliver the President's Address. The intervening months only added anticipation which is no cure for anything. The final countdown began a few seconds ago. There is no turning back.

Before I get into the address, I would have liked to have shared this nervous pride with my beloved parents, Mr. and Mrs. Marvin Uphaus, Sr., to whom I will be forever grateful for their sacrifice, attention and concern in providing me the tools of science when they were needed. I eagerly pass to them the glory and honor that have been mine. Unfortunately, they were unable to be with me tonight.

My second word of thanks goes to one who has done his share to put me in this position tonight. He claims I'm his right hand. I could almost claim he's my brain for he has guided me this year through three Presidencies: As President of the McGill Science Club, as President of the Mobile Regional Science Fair, and lastly as President of the Alabama Junior Academy of Science. I publicly and gratefully say "thank you" to my physics and mathematics teacher, Brother Cyr.

I have entitled tonight's address: SPACE—THE NOTHINGNESS WE WILL CONQUER. While it appears timely in the light of recent developments and spectacular advancements during the

last six months, space has been the special challenge to the intelligence of the most brilliant of men throughout the ages.

In earliest times ordinary birds using the air as their normal medium of travel were a constant wonder, and still are, to those who sought a similar means for humans. The tiny bird with all his built-in facilities remains in front of man who must be content with additions outside himself to duplicate what is so easy and normal for flight. Flapping wing assemblies brought death to many experimenters, as we know. Gliders and balloons took their place, and men had to be satisfied with these humble successes.

Around the turn into this century the Wright Brothers, familiar figures in American aviation, developed a crude craft that could sustain itself in air. That, mind you, was a mere 50 years ago. World War I found a use for these machines, which unfortunately swerved to destruction. World War II followed with speedier planes than could be imagined and served only to whet the appetite to go faster and faster still.

On the other side of this conflict was a small group of scientists who devoted all their thoughts and energies to a new kind of craft, the formidable V-1 and V-2 rockets that rained havoc upon Britain during the closing months of the struggle. Luckily, these same scientists surrendered to us, and have since, with the help of the Government, thrown themselves into the projects that have interested us ever since. Dr. Von Braun had considered huge rockets that would escape this atmosphere-bound planet of ours. His efforts and convictions have borne fruit.

The mind of man has already invaded space in the form of electronically reporting satellites, four (or three) of which are at this very moment orbiting around the earth. Our Explorer provides much information of matters that have concerned us for quite some time. Cosmic radiation, for instance, within the 200 to 1,600 mile orbital heights is no more than 12 times that on the earth's surface, an increase which scientists do not consider very large. Radiations of this type on initially brief space flights will be no problem, but the prolonged periods of exposure may create high levels of danger. By the time really extended space flight is accomplished enough will be known about cosmic radiation to lessen the problem. Again, Explorer tells us about the density of the upper atmosphere as indicated by its life before it falls to earth; about density of certain geographical locations on our planet as evidenced by dips in the satellite's orbit; about the propagation and skip con-

ditions affecting radio waves. As long as Explorer and others to follow are in orbit, we will continue to learn.

This initial step has enticed us to go further in thought and development. What comes next? The most logical answer would be a manned space station revolving around the earth in much the same way as our satellites. It would be a self-centered, self-contained world with a regularly assigned crew, living quarters designed for maximum comfort, its own gravitational system and its own oxygen provision unit. Hurtling around the world it will provide superb reconnaissance and observance facilities, and a continuing flow of data on cosmic rays, meteors and the like. Further, it may provide a much easier launching position for the inevitable trip to the moon, since the atmosphere-less surroundings would not present the launching difficulties encountered on earth, with its escape velocity of 25,000 mph and consequently enormous thrust needs.

There are several possible ways to establish a permanent manned station. One could simply fire into orbit a vessel containing a man and considerable equipment. This seems to be, on first thought, the easiest solution, but on second thought, we find it is not the best. The necessity of choosing a sole volunteer to carry the burden of the physical and the psychological strains attached to his assignment would alone outweigh this method.

The more complicated approach to establish a manned station station would be to fire the components and a team of specially selected men into orbit, and then have them put the pieces together in space. This idea is more logical and fruitful. With this method a multi-stage rocket containing the men and the light-weight pieces of the station would be fired into orbit. These parts would provide basic living quarters for the crew, with more elaborate components to be sent up later. When the final stage of the rocket arrived at its orbital position, the team clad in space suits would unload the components in space and pull them together to build initial living quarters, filling them with oxygen and supplies. As they worked with the components, the men could maneuver by the use of small rocket guns. Since everything would be moving at the same speed, the weightless parts could easily be pushed around by the men. Once the quarters are built, part of the team would return to earth. The return trip would be effected by a portion of the original vehicle designed for re-entry into the earth's gravitational and atmospheric fields. Later other rockets would bring additional crews, parts, and supplies to expand the station. Of course, the most rig-

orous celestial mathematics and astronautics would be necessary to get the components at the right place at the right time. From this manned space station, the next step in mankind's dream of the ages—with President Eisenhower's permission and two billion dollars—the flight, landing, and establishing of a permanent base on the moon.

Aside from man's adventurous nature and the romance of the stars and planets of the limitless heavens why should man want to go to the moon? Dr. Edward Teller at a recent Congressional hearing was asked this very question. Dr. Teller answered that it would be interesting and scientifically important to find out what was on the moon. Asked later what he thought we would find there, Dr. Teller answered, "Russians." It is for this very reason that the United States must gain control of the moon, which some are convinced will mean control of the earth and who strongly urge our nation's forces to establish themselves there as soon as possible. The over-all view sees the United States goaded into swift efficient action after Russia's success with Sputnik I. In the race for the moon second place is worthless.

Militarily speaking, and that's how we'll speak since the operations of missiles and satellites are in the hands of the Army and Navy, the moon affords excellent views of the earth. From that position retaliatory missiles could be launched toward the earth with only 20 per cent of the thrust required on earth. Thanks to the lack of resistant atmosphere they could be catapulted with no internal propellant required.

Once launched the moon crew could track and guide it because there are no atmospheric resistance, weather disturbances or other factors prevalent on the earth. Construction and transportation problems are lessened because of much lower gravitational pull, and since one-half of the moon is always turned away from the earth, the consequent concealment of retaliatory facilities on the far side greatly enhances the strategic position.

Attendant to the settlement of the moon follow the serious and ponderous questions of sovereignty and international law. According to a previous time-honored interpretation of international law a country's boundaries extended downward to the core of the earth and upward "ad infinitum," forming a giant wedge. In simple language, all the earth and space contained within the wedge legally belonged to the specific country. But because neither the United States nor Russia asked permission to launch satellites during the Inter-

national Geophysical Year programs and because no nation protested the satellite invasion of space, it can be logically argued that the present upper reaches of a nation extend upward not "ad infinitum" but rather *only* to the point where the atmosphere ceases to provide lift for airplanes and balloons. Whatever is beyond can be looked upon as another free domain or "no-man's-land." When the times comes, if not before, a strict definition of this boundary must be determined by some kind of international agreement. Getting there first will certainly aid the Russians to agree with such a proposal. The desirability of a demilitarized space and its implications for a peaceful world are difficult to deny. But while the debate goes on, the United States cannot let space go by default to any other nation. The "green light" granted by President Eisenhower recently dispels a great portion of misgiving the American people might have had in Operation Moon.

We read in the comic strip "Born Twenty Years Too Soon" its truth veiled in delicate humor. I can well imagine Jules Verne in a similar situation, possibly termed "Born a Hundred Years Too Soon," Jules Verne who would relish the numerous projects devoted to nuclear submarines and particularly to space ships which he had envisioned in his famous writings. Inspecting the bases at Cape Canaveral and others throughout the country, talking over plans with Dr. Von Braun would furnish hours and hours of sheer enjoyment.

The trip to the moon would be a topic of major seriousness and complicated consequences. It would be the first instance of space navigation—or astrogation, as it is called. It is the process of hurling an object from the orbit of one celestial body into the orbit of another at a carefully selected time and speed, so the object arrives at a point on the orbit of the second body where both are at precisely the same speed to enable landing. One degree, or a mere part of a degree, of inaccuracy from perfection could mean an error of millions of miles depending on the distance from the desired termination. It would therefore be constantly necessary to check a vehicle"s position in all three spatial dimensions and according to Einstein's concept of the universe, the fourth dimension of time. Then with the use of rocket controls the course could be altered. In this vacuum of space, however, the astrogator could always see his reference points with perfect visibility. Possibly, the majority of the course could be pre-planned by computers. These perplexing answers will come along in their proper time with the reality of space travel, no doubt. It is closer at hand than most men realize.

Man will not conquer space until he has penetrated it in manned vehicles completely under his control. Reminiscent of Buck Rogers? of Flash Gordon? Maybe yes—maybe no, but certainly at this stage we could easily pass into such means of transportation. Evidently he will seek and eventually design a craft that will travel the outer realms with comparative ease and comfort. However, at the present moment the man of today will have to submit himself to the rigorous ordeals accompanying space travel. Can he survive these ordeals? Will his physiological and psychological limitations allow him to carry on vital life functions in an entirely new habitat?

He must continue to breathe in a cabin surrounded by a void that could make his blood boil. He must endure the strain of violent launching acceleration that for several minutes will multiply his weight ten times. Then in a few minutes he will enter the realm of weightlessness where gravity has a negligible effect. He will have to work in a small enclosure for long periods of time with only the company of a few shipmates under equally heavy stress.

The amount of torture and punishment the human body can endure is fantastic and it is relatively sure that man will be able to cope with all the physical problems of space travel and with careful preparation the psychological as well. Col. John Paul Stapp, to find out how many G's man can endure, hurtled through a succession of harrowing rides on a rocket sled at Holloman Air Base, New Mexico. The term G is used to measure the pull of gravity equal to the man's weight. As he accelerated to a speed of 632 mph and came to a dead stop, Col. Stapp took forces as high as 40 G's for one-fifth of a second. In the process he suffered broken ribs, a torn retina, and several hemorrhages. But when he was through, he had demonstrated that man can tolerate the massive G forces of a space-bound rocket.

Shooting upward in a multi-stage rocket vehicle, the first spaceman will undergo G forces in "notched accelerations" as each motor ignites, whooshes up, and then coasts along until the next stage takes over. With present day rocket fuels, peaks of 8 or 9 G's might last as long as 3 minutes. Tests show man can cope with these peaks best if he is protected by a special pressurized G suit and lies prone so that head and heart are level. But during these moments of high acceleration, not too much should be expected of him, other than to press a button which would eject him in case of rocket failure. A

new rocket-sled-track, by the way, measuring seven miles in length has been opened up which will permit accelerations up to 200 G's!

Dr. Hubertus Stughold, German-born physiologist and "father of space medicine," has designed an exquisitely balanced environment which will be the space capsule. Dr. Stughold fondly calls these space capsules "terrellas" or "small earths." At Randolph Field, Texas, Air Force Airman First Class Donald Farrell of New York City was wired with electrodes and ushered into this specially designed terrella and spent seven days and nights inside, the estimated length to the moon and back. While in the terrella, Airman Farrell operated a radar screen and performed other moon-trip tasks—all without any ill effects, while attendants altered conditions of oxygen, temperature and humidity. The tests proved definitely that reliable terrellas can be built that will sustain man through take-off and powered flight through the atmosphere.

The space traveller will go from one extreme to another, from the crushing forces of multiplying G's at take-off to zero gravity when he enters the point when his outward speed or centrifugal force exactly balances and cancels out downward pull of gravity exerted by the earth. This wierdest of new dangers, we call weightlessness. We ourselves experience this strange zero gravity when springing from a diving board, driving fast over a sudden dip in the road, or going over the top of a roller coaster. Pilots, like Joe Kittinger, can put their jets into high-speed parabola trajectories which duplicate what seems to be a condition of weightlessness for periods of up to 30 or 40 seconds. As Joe puts it, "I stick out my foot and it just stays there like something that isn't part of me."

Continued weightlessness for long durations may be another matter. Russian scientists had analyzed the radio-relayed pulse, blood pressure and respiration of Laika, Sputnik II's space-dog, and concluded that "no harm comes to a living organism" in a zero gravity state. Breathing and digestion seem to present no problem. But there is some evidence that weightlessness produces mental befuddlement and air sickness.

Without gravity pull, body sense organs will continually pass false information to the brain. The sensitive mechanisms of the ear which help us to keep our balance will be no longer useful. Balance will be provided by the eyes.

The human mind will submit long before the body. An individual's reaction to isolation is a major problem in the psychological

field of space flight. Major David Simons, the medical doctor who rode a balloon gondola for 32 hours at the edge of space last summer, recently described his own feelings: "On the flight I often had to force myself to think—it was a tremendous task. One thing I had to fight was what you might call loss of initiative, resulting mainly from tiredness and a feeling of complete isolation from earth." Peak efficiency seems impossible.

After outlining some of the difficulties that face those who will travel out into space, the sane thinker can only feel a sense of staggering helplessness. Here we are the most skilful, most resourceful, the best trained—every kind of brilliance in any science is ours to share at any given moment, and yet all this put together does not afford us the ready answers to these perplexing problems that arise from day to day.

Without doubt man will not be at all satisfied with his newfound possession when he establishes himself on the moon. He will want to go on to the other neighboring planets which have been of great interest for some time. Mars, Venus, Jupiter will be his stepping stones to other solar systems, some probably unknown to us at present. Each would present its own problems, such as atmospheric pressures, temperature variations and so forth. As in the past, one difficulty at a time will be solved only to have another staring him in the face. But, each will be conquered. The possibilities of new methods of propulsion, either by nuclear fission or ion propulsion, will open the way to the planets in other solar systems in distant galaxies. The possibility of the application of Einstein's theory of relativity in which mass will be converted directly into energy traveling at the speed of light squared leads us to believe that man may some day be able to go to any point in our finite universe, also defined by this theory, and return within his life-time.

Every aspect of this tremendously astounding project requires, as I have enumerated, the individual and specialized skills of the physicist, the mathematician, the chemist, the biologist, the medical doctor, the psychologist, and many more important scientists who contribute a tiny piece of data here and there to integrate the sum total of knowledge that will provide the information that must be learned before traveling about in space is reduced to riding about up there.

I want to take particular pains to impress the members of the AJAS, who like me are about to step boldly with some knowledge of the tasks that lie ahead. There is no fancy dreaming to see our-

selves in the positions which will bring us into close contact with these very operations that are just getting underway.

Though humorous, it bears much truth, that thanks to our devoted teachers we are analagously little satellites propelled into the orbits of science by their enthusiasm, dynamism, interest and sometimes sheer determination in our success.

While they sit back contentedly viewing us in orbit, let us take our places beside the accomplished scientist who does what interests us most. In the meantime we must steep ourselves in our particular science; if I might say, drown ourselves in the depths of knowledge. Each new facet of knowledge will certainly lead on to others and in a relatively short time we will be the ones who will head these very projects or more advanced ones that are part of our experience of today. Without doubt we will be a part of this entire project. We simply can't avoid it.

Who knows? Someone in this room may be part of the space-traveling crew I described earlier. It behooves me and you to think, to plan, to join promptly. Countdown begins now.

Thank You

Minutes of the Alabama Junior Academy of Science

TWENTY-FOURTH ANNUAL MEETING

Howard College, Birmingham, Alabama

April 1-2, 1958

The official delegates, officers, nominees with Brother Cyr, S. C. and Mrs. Lucille Lloyd met in caucus in the Administration Building, Howard College, Birmingham, Alabama at 10:30 A. M., April 1, 1958. The meeting was opened by the President, Marvin Uphaus. The schools attending this 24th Annual Convention at Howard College were:

School	*Official Delegate*
Athens	Sharon Chisholm
Baldwin County	Faye Prestwood
Bishop Toolen	Barbara Mayes
Butler	Barbara Roth
C. F. Vigor	Sammy Wood
Choctaw County	Elaine Brooks
Coffee High	John Koger
Dora	Johnny Key
Ensley	David Lynn
Fairhope	Billy Jordan
Foley	Joe Browne
**Hayneville	Janet Bozeman
Hewitt-Trussville	Gene Harris
Hueytown	Jo Ann Higdon
Marion Institute	Frank Bockman
McAdory	Jackie Carroll
McGill Institute	Emmett Evans
Mercy	Lynn AuCoin
Minor	Frank Haynes
Montevallo	Joselynn Blakeley
Murphy	Jack Herring
Parrish	Lamar Frazer
Semmes	Jimmy Harrison
St. Bernard	Sylvester Thomas
Talladega	Alice Venable
Tallassee	Mary Whaley
Tuscaloosa	Brian Tunstall
Tuscaloosa County	John Curry
West End	Harriet Nabors

Woodlawn	Bill McCulla
**Julius T. Wright	Annise Waterman

***Voted in at the Convention*

At the caucus the Secretary called the roll. All schools were present except: Butler, Choctaw County, Dora, McAdory, Tallassee, and Tuscaloosa County. The President then read the by-laws to the Constitution regarding the rules for campaign posters. The nominees for office were asked to leave the room.

The motion was made by Jack Herring, Murphy High School, that since there were only two nominees for President and for Treasurer, they would be automatically accepted for the slate of final election. It was seconded by Emmett Evans, McGill Institute. The motion was carried.

Each of the nominees was called in individually to speak in his own behalf. Mike McCormick, nominee for Treasurer, was not present.

While the votes were being counted by the Secretary, Anne McDonald, and Vice-President, Andy Niedenthal, it was announced by the President that two new high schools were up for membership in the AJAS. They were: Julius T. Wright School for Girls, Mobile, Alabama and Hayneville High, Lowndesboro, Alabama.

The President announced the following slate of officers after the votes of the official delegates were counted:

President: Theresa Hagendorfer, Foley High School; Eleanor Long, Woodlawn High School.

Vice-President: Larry Yarbrough, Vigor High School; Edward Houlihan, St. Bernard High.

Secretary: Joyce Donivan, Mercy High School; Joann Bonham, Tuscaloosa High.

Treasurer: Eric Revere, McGill Institute; Mike McCormick, Ensley High School.

The candidates were presented their ribbons by the Secretary. The meeting was adjourned by the President until the 1:00 business meeting.

The President, Marvin Uphaus, opened the business meeting at 1:00 in the Library. The Secretary called the roll. The schools absent from this meeting were: Butler and Coffee.

The President announced that the executive committee at their meeting in November appointed Homer Thompson, C. F. Vigor, Treasurer of AJAS, chairman of the resolutions committee. Homer Thompson then read the names of committee members and asked

that they meet him after the business meeting to arrange a time for an official meeting. The resolutions committee members were:

> Homer Thompson, C. F. Vigor High School; Mrs. Lucille Lloyd, C. F. Vigor High School, sponsor; Brother Cyr, S. C., McGill Institute, sponsor; Miss Lillian Leonard, Baldwin County, sponsor; Angela Mallini, Bishop Toolen High School, Nellie Jo Prestridge, Talladega High School, Bob Bullington, Athens High School, Frank Bockman, Marion Institute.

The official slate of officers was announced and candidates were presented. The President read the schedule for the rest of the day and also for the next. It was announced that there would be a meeting at 6:15 in the Library for the campaign speeches.

The President then introduced Dr. John A. Southern. Dr. Southern welcomed everyone officially to Howard College. He announced that the Birmingham bus strike which began the night before had hit us hard. He was very grateful to the Mobile group that came up on two Greyhound buses, because they could supply adequate transportation to and from the Fairgrounds and for the tours for those without private cars. Dr. Southern went on to say that one bus would be used to go to Southern Research Institute and one to the Medical Center. Private cars would be used for the tours to the blast furnace and Connors Steel Company. Because of the small number wishing to go to the blast furnace, that tour was cancelled. It was announced that a film would be shown between 2:30 and 5:00 in Room 109 in the English Building.

Those boys and girls with projects were not allowed to go on the field trips because they had to be with their projects for interviews with the judges.

There being no further business, the meeting was adjourned by the President.

Because of the distance between the Fairgrounds and the College and because of lack of time, there was no meeting at 6:15

The annual banquet was held in the Cafeteria. Marvin Uphaus, McGill Institute, President of the AJAS, gave the President's Speech entitled: "Space—the Nothingness We Will Conquer." The eight finalists were announced in the judging of scientific papers. The winners of the Alabama State Science Talent Search were announced.

We were then ready for the party which took place in the Cafeteria, which meant moving a few tables to add to the already adequate room. An accordion group provided lively music and vocals.

Several boys from the college entertained by gymnastics on the trampoline. We had a campaign rally at which all candidates and their managers spoke in their own behalf or for their candidate. It proved very interesting, entertaining and quite different.

At 9:10 Wednesday morning, April 2, 1958, the President opened the meeting. The Secretary called the roll. Those schools not present were: Butler, Dora, Montevallo, Talladega, Tuscaloosa County, Woodlawn and Parrish.

The eight finalists read their papers. They were:

1. Radioactivity and Fall-Out in Civil Defence—Charlotte Vessels, Athens High.
2. The Importance of Atomic Energy and Scientific Principles in this Advancing Democracy — Barbara Mayes, Bishop Toolen High School.
3. Natural and Synthetic Polymers—Gilbert McLean, Ensley High School.
4. Experimenting With Crystal Growth—Roland Walker, Foley High School.
5. The Use of Radio-isotopes in Medicine—Jimmy Wright, Hueytown High School.
6. Bacteriology—Betty Turpin, Mercy High School.
7. Rapid Sand Filter Water Purification Plant—James Snow, Tuscaloosa High School.
8. Some Evidence From Comparative Anatomy of Man's Evolution—Ronald Evens, West End High School.

After the reading of these papers, the president announced that we would have a "seventh-inning stretch."

The President reopened the meeting at 10:20. The Secretary called roll. All schools were present except Dora, Hewitt-Trussville, and Parrish. In the form of old business the president read the proposed amendment to the Constitution made by the executive committee. The amendment reads as follows:

1. That Section 2 of Article IV (Officers) be amended by the addition of the following sentence:

   In the event of non-performance of duty by any officer, and upon the recommendation of the Executive Committee, the Chapter represented by that officer shall be excluded from the nomination of officers at the Convention affected and at the two conventions immediately following.

2. That the Section called NOMINATION under the Article called ELECTION OF OFFICERS in the By-Laws be amended by the following additional sentence in Paragraph 1:

   No nominees may be proposed except those for whom Form III has been completely filled out and submitted according to directions contained therein.

There was a discussion on this amendment. Jack Herring, Murphy High School, asked whether it would affect Murphy, since the Secretary of the AJAS last year from Murphy, did not come to the convention. The answer was, "No, it could not be made retroactive." Lynn AuCoin, Mercy High School, moved that this amendment be accepted by the AJAS. Jack Herring seconded the motion. Again there was an open discussion. The official delegates then voted and the motion carried unanimously.

The candidates for the slate of officers were again introduced and asked to step forward so that "all can get a good look and then make your final decision."

Then the official delegates voted by secret ballot. The votes were counted by the Secretary and the official delegate for Julius T. Wright School for Girls, Annise Waterman, who could not vote.

The President asked for a show of hands from the official delegates in favor of Hayneville High becoming a member of the AJAS. A like show of hands was asked for Julius T. Wright School. Both schools were unanimously voted in. Dr. Patton brought up Marbury High from the floor to be accepted. Official vote was again unanimous.

The President proceeded and asked the chairman of the resolutions committee to read the resolutions.

"Be it resolved that the Alabama Junior Academy of Science go on record as extending its thanks to the following: to Dr. John Fincher, Dean of Howard College, and to Dr. J. A. Southern, especially, Counselor of Local Arrangements, and all other members of the Howard College Faculty who made this visit enjoyable; to student co-workers, in particular Mr. Cliff Coppage, who gave up their spring holidays to assist in the smooth operation of this convention; to the cafeteria management for splendid service and excellent meals, and for the continuation of this same service this noon; to the members of the Senior Academy for their assistance and inspiration, especially to Mr. Reuben Boozer, chairman of judging, Jacksonville State College, and his corps of judges: Dr. Frank Stevens, Dr. Eric Rodgers, Mr. W. H. Bancroft, Jr., Mr. P. P. Powell, Mr. Thomas Simpson, and Dr. E. G. Patton.

"We extend thanks to Mrs. Doris Griffith, the accordion band, and tumblers from Shades Valley High School, who furnished the entertainment after the banquet.

"Our special gratitude to Dr. E. G. Patton, chairman of counselors for the AJAS, who with unstinted generosity has served this organization for the last three years; to the President, Marvin Uphaus, his officers, and their sponsors, who carried this convention to its success; to the Fairgrounds Committee for the use of the 4-H barracks.

"We wish to thank the Mobile area for the use of their buses to transport students and sponsors to and from the Fairgrounds and Howard College; and for making it possible to visit Southern Research Institute and the Medical Center, since the city buses were on strike."

Signed: Homer Thompson, chairman, Angela Malinni, Nellie Jo Prestridge, Bob Bullington, Frank Bockman, Mrs. Lucille Lloyd, Miss Lillian Leonard, Brother Cyr, S. C.

Homer Thompson then read the MEMORIAL TRIBUTE.

> "In Memory of Sister Mary Charles, O.S.B., who was honored as Science Teacher of the Year, 1957, the Junior Academy of Science expresses regret at her untimely passing during the present school year. We wish to extend our deepest sympathy and regrets to her Sisters, to her school, and to her community. She will be missed by us all for her untiring labors with the Alabama Junior Academy of Science. We will remember her as a sympathetic, loyal, and faithful worker."

Jack Herring, Murphy High School, moved that these resolutions and that this memorial tribute be accepted. Sylvester Thomas, St. Bernard Prep, seconded the motion. The motion carried.

Homer Thompson asked that each chapter send a "get-well" card to Dr. James L. Kassner, who was unable to attend this convention. The President was asked to send a telegram in the name of the AJAS to the same effect.

The president announced a much-needed 10-minute break.

The President reopened the meeting after the short recess, and then turned it over to Dr. Gibbes Patton. Dr. Patton presented Frank Bockman, Marion Institute, and Mary Whaley, Tallassee High School. their charters as members of the AJAS.

He also presented THE ALABAMA ACADEMY AWARD FOR 1958 which reads as follows:

"The Alabama Academy Award for 1958 was conferred upon Mrs. Lucille Lloyd of C. F. Vigor High School, Prichard, Alabama at the twenty-fourth annual convention of the Alabama Junior Academy of Science, held at Howard College, Birmingham on April 1-2, 1958. The award consists of a gold key accompanied by a certificate of citation. It is annually given by the Alabama Academy of Science for meritorious teaching of science in the state. The purpose of the award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students, as evidenced by their sponsorship of science clubs active in the Alabama Junior Academy of Science.

"Mrs. Lloyd has been sponsor of her science club almost continuously since 1944. Her club has a record of regular participation in the events of the annual Junior Academy convention. Not only has she been active as a club sponsor and as a teacher, but she has contributed greatly to the increasing success of the Science Fair activity in the Mobile region, and she has supported the work of the Mobile Academy of Science. It is in recognition of her vigorous and steady support of these youth-centered activities that Mrs. Lloyd is presented with the 1958 Alabama Academy Award."

Dr. Stevens presented cups to the schools that placed in each group.

Group I (10" cup)	First Place:	Janice Alicia Clark Embryonic Development of the Chicken S. R. Butler High School Mrs. I. K. Bradford, Sponsor
8" cup	Second Place:	Marvin W. Osburn Regeneration of the Planaria Parrish High School Mrs. Harry Reid, Sponsor
Certificate	Third Place:	John Curry A Study of Paleontology in West Alabama Tuscaloosa County High School Mrs. W. B. Hargrove, Sponsor

Group II 10" cup First Place: John Morrow
New Process for Making Sulfuric Acid Using Waste Gases
Coffee High School
Mr. E. G. Dorris, Sponsor

8" cup Second Place: Robert Steham
Frozen Free Radicals
Decatur High School
John Teague, Sponsor

Certificate Third Place: Hayse Boyd
Chemical Soil Analysis of Tuscaloosa County
Tuscaloosa County High School
Mrs. W. B. Hargrove, Sponsor

Group III (10" cup) First Place: Patrick J. Malloy
Cudin Coil
St. Bernard High School
Father Charles Reiner, Sponsor

(8" cup) Second Place: Barbara Thomas
Hydraulic Lift
Foley High School
Clyde J. McSpadden, Sponsor

Certificate Third Place: David Wilson
Newtonian Reflecting Telescope
Athens High School
Mrs. Hazel Ruff, Sponsor

Group IV (10" cup) First Place: James Snow
Rapid Sand Filter Water Purification Plant
Tuscaloosa Senior High School
Mr. William Lindsey, Sponsor

(8" cup) Second Place: Mike Carpenter
Miniature Long Range Finder
Woodlawn High School
Mr. Reynolds, Sponsor

Certificate Third Place: Jimmy Nelson and Christine Bailey
Petroleum—from Earth to You
Hueytown High School
Miss Edith Geisler, Sponsor

Winning scientific papers were announced as follows:

(10" cup) First Place Jimmy Wright
Radio-isotopes in Medicine
Hueytown High School
Miss Edith Geisler, Sponsor

(8" cup) Second Place: Ronald Evans
Some Evidences from Comparative Anatomy of Man's Evolution
West End High School
Miss M. B. Hafling, Sponsor

Certificate Third Place: James Snow
Rapid Sand Filter Water Purification Plant
Tuscaloosa Senior High
Mr. William Lindsey, Sponsor

The A.A.A.S. Awards were presented to:

Girl—Betty Turpin, Mercy High School, Mobile, Alabama; Sister Mary Robert, Sponsor.

Boy—Bill Whitlow, Ensley High School, Birmingham, Ala.; Miss K. Boehmer, Sponsor.

The President announced that the Southern Research Institute had invited students to visit their plant at 1:30, Wednesday, April 2.

The final business was the announcement of the new officers. The President reversed the order and created suspense at each level. The new officers are:

President: Theresa Hagendorfer, Foley High School; Mr. Clyde J. McSpadden, Sponsor.

Vice-President: Larry Yarbrough, C. F. Vigor High School; Mrs. Lucille Lloyd, Sponsor.

Secretary: Joyce Donivan, Mercy High School; Sister Mary Robert, Sponsor.

Treasurer: Eric Revere, McGill Institute; Brother Cyr, S. C., Sponsor.

Theresa Hagendorfer officially closed the twenty-fourth annual meeting of the AJAS.

Following is the list of the exhibits entered in the twenty-fourth convention of the AJAS, April 1-2, 1958:

BIOLOGY

1.—A Study of Paleontology in West Alabama .... John Curry
Tuscaloosa County High
Mrs. Hargrove, Sponsor

2.—Insects in General .... Wayne Skelton
Dora High School
Miss D. Ellison, Sponsor

3.—Regeneration of the Planaria .... Marvin Osburn
Parrish High School
Mrs. H. Reid, Sponsor

4.—Development of Heart of Chicken .... Ann Evans
Mercy High School
Sister Mary Robert, Sponsor

5.—Blood Relationship in Animals .... Kenneth Harris
Minor High School
Miss M. McCluskey, Sponsor

6.—Tropisms .... Eric Revere
McGill Institute
Brother Cyr, S. C., Sponsor

7.—100,000,000-Year-Old Fossils of Selma Formation .... Margie Mantel
Tuscaloosa Senior High
Mr. W. Lindsey, Sponsor

8.—Look For It—Cancer .... Carolyn Starkey
Semmes High School
Mrs. Mary Ward, Sponsor

9.—Problems in Dentistry .... Bill McHardy
St. Bernard Prep.
Father David Bowes, Sponsor

10.—Cerebral Palsy .... Lady Anderidge
Murphy High School
Miss E. Craddock, Sponsor

11.—The Influence of Environment on Birds .... Irma King Lindsey
Choctaw County High

12.—The Embryonic Development of a Chicken .... Janice Alicia Clark
Butler High School
Mrs. I. K. Bradford, Sponsor

13.—Birds and Flowers .... Charles Strong
Baldwin County High
Miss Lillian Leonard, Sponsor

14.—Blood Fractions .... Peggy Smith
Julius T. Wright School
Mrs. Reardon, Sponsor

15.—Insects .... Carolyn Crowell
Murphy High School
Miss E. Craddock, Sponsor

16.—Hydroponics .... Mickey Moorer
Mercy High School
Sister Mary Robert, Sponsor

CHEMISTRY

1.—Chemistry of Wood .... James Reeves
C. F. Vigor High School
Mrs. L. Lloyd, Sponsor

2.—Into Whose Hands .... Barbara Mayes
Bishop Toolen High School
Sister Joan Clair, Sponsor

3.—I Am Everything .... Angela Mallini
Bishop Toolen High School
Sister Joan Clair, Sponsor

4.—Water Analysis .... John B. Walters, Jr.
Montevallo High School
Miss Ethel Harris, Sponsor

5.—New Process for Making Sulfuric Acid
from Waste Gases .... John Morrow
Coffee High School
Mr. E. G. Dorris, Sponsor

6.—Effects of Chemical Agents on Bacteria .... Faye Prestwood
Baldwin County High
Miss Lillian Leonard, Sponsor

7.—The Liquid State and Its Shape .... Gilbert M. Melcher, Jr.
McGill Institute
Brother Cyr, S. C., Sponsor

8.—Exploring With Crystal Growth .... Bob Kaiser
Foley High School
Mr. Clyde J. McSpadden, Sponsor

9.—Chemical Analysis of Soil of
Tuscaloosa County .... Hayse Boyd
Tuscaloosa County High
Mrs. W. Hargrove, Sponsor

10.—Frozen Free Radicals .... Robert Stehman
Decatur High School
Mr. J. Teague, Sponsor

11.—Paint Pigments from Chemical
Combinations .... Lucy McCombs
West End High School
Miss M. Hafling, Sponsor

12.—Chemical Analysis of Gall Stones
and Kidney Stones .... J. W. Land
Choctaw County High School

PHYSICS

1.—Coudin Coil .... Patrick J. Molloy
St. Bernard Prep.
Father Charles Reiner, Sponsor

2.—Hydraulic Lift .... Barbara Thomas
Foley High School
Mr. Clyde J. McSpadden, Sponsor

3.—Newtonian Reflecting Telescope .... David Wilson
Athens High School
Mrs. H. Ruff, Sponsor

4.—Nuclear Quadrepole Spectrometer .... Luther Fuller
Ensley High School
Miss Boehmer, Sponsor

5.—Ripple Tank .... Ken Elliott
Parrish High School
Mrs. H. Reid, Sponsor

6.—Comparison of Hydrogen and
Atomic Bombs .... Janet Bozeman
Hayneville High School
Mrs. W. J. Bozeman, Sr., Sponsor

7.—Iron Propulsion System .... Bill McCulla
Woodlawn High School
Mr. Reynolds, Sponsor

8.—Theory of Flight .... Curtis Rigsby
C. F. Vigor High School
Mrs. L. Lloyd, Sponsor

9.—Nim Computer .... Bob Turner
Butler High School
Mrs. Bradford, Sponsor

SCIENCE IN INDUSTRY

1.—Rapid Sand Filter Water
Purification Plant .... James Snow
Tuscaloosa Senior High School
Mr. W. Lindsey, Sponsor

2.—A Forced-Air Furnace .... Bob Bullington
Athens High School
Mrs. H. Ruff, Sponsor

3.—Petroleum—
From Earth to You .... Jimmy Nelson and Christine Bailey
Hueytown High School
Miss Edith Geisler, Sponsor

4.—Miniature Long-Range Finder .... Mike Carpenter
Woodlawn High School
Mr. Reynolds, Sponsor

5.—Industrial Soaps .... Martha McClinton
Hueytown High School
Miss E. Geisler, Sponsor

SCIENTIFIC PAPERS
BIOLOGY

1.—Look For It—Cancer .... Carolyn Starkey
Semmes High School
Mrs. Mary Ward, Sponsor

2.—Bacteriology .... Betty Turpin
Mercy High School
Sister Kay Robert, Sponsor

3.—Your Skin and Mine .... Doris Ann Hendrix
Coffee High School
Mr. E. G. Dorris, Sponsor

4.—Some Evidence from Comparative Anatomy
of Man's Evolution .... Ronald Evans
West End High School
Miss Mary Hafling, Sponsor

5.—A Study of the Frog's Nervous System .... Frank Haynes
Minor High School
Miss M. McCluskey, Sponsor

CHEMISTRY

1.—Importance of Scientific Principles and Atomic Energy
in this Advancing Democracy .... Barbara Mayes
Bishop Toolen High School
Sister Joan Clair, Sponsor

2.—Exploring with Crystal Growth .... Roland Walker
Foley High School
Mr. C. J. McSpadden, Sponsor

3.—Unsolved Mystery of Wood .... Jerry Bedingfield
C. F. Vigor High School
Mrs. L. Lloyd, Sponsor

4.—Natural And Synthetic Polymers .... Gilbert McLean
Ensley High School
Miss K. Boehmer, Sponsor

5.—Radio-isotopes in Medicine .... Jimmy Wright
Hueytown High School
Miss Edith Geisler, Sponsor

SCIENCE IN INDUSTRY

1.—Rapid Sand Filter Water
Purification Plant .... James S. Snow
Tuscaloosa Senior High
Mr. W. Lindsey, Sponsor

PHYSICS

1.—Inverse Square Law .... Emmett Evans
McGill Institute
Brother Cyr, S. C., Sponsor

2.—Radioactivity and Fall-out
in Civil Defense .... Charlotte Vessels
Athens High School
Mrs. H. Ruff, Sponsor

Respectfully submitted,
Anne McDonald
Secretary AJAS, 1958

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

(Affiliated with A.A.A.S.)

OFFICE OF THE EDITOR
ALABAMA COLLEGE
MONTEVALLO, ALABAMA

VOLUME 30 OCTOBER, 1958 NUMBER 2

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The Journal of the Alabama Academy of Science is published four times each year, in July, October, January, and April, and is sent without charge to all members of the Academy.

CONTENTS

SECTION I

BIOLOGICAL SCIENCES

Microorganisms Isolated from Sclerotia of Sclerotium rolfsii and their Antagonistic Effects upon the Pathogen

E. A. CURL

Alabama Polytechnic Institute, Auburn, Ala.

Studies of the relationships of associated soil microorganisms to the behavior and survival of the soil-borne plant pathogen, **Sclerotium rolfsii,** were initiated in 1957.

A large number of sclerotia of the pathogen, collected from soil of several white clover fields, were shaken in sterile water-blanks in the laboratory to place in suspension the microorganisms from the surface of the sclerotia. The sclerotia were washed twice more, then crushed, and sterile-water suspensions again made to obtain organisms that were embedded deeply in the sclerotia. Fungi, bacteria, and actinomycetes were isolated from the microbial suspensions by the dilution plate method. The fungi and actinomycetes were tentatively identified to genus or species. The bacteria were grouped on the basis of morphological and cultural characteristics. Representative isolates were tested on Czapek-Dox agar for antagonistic effects upon **S. rolfsii.**

Thirty-five kinds of fungi, 13 bacteria, and 15 actinomycetes were isolated from sclerotia. **Cephalosporium** sp. and an unidentified isolate were the predominant fungi in surface washing suspensions. **Cephalosporium** sp. and **Sclerotium rolfsii** were most abundant in crushed-sclerotium suspensions. Species of **Penicillium, Aspergillus, Trichoderma, Fusarium,** and a number of unidentified fungi were obtained from both suspensions. **Sclerotinia** sp. was isolated only from crushed sclerotia. Two of the bacterial isolates were obtained in much greater numbers from crushed sclerotia than from surface washings. Most abundant of the actinomycetes were species of **Micromonospora** followed by **Streptomyces** spp. and **Nocardia** spp. One species of **Micromonospora** was much more abundant in crushed-sclerotium suspensions, and 1 species of **Nocardia** was obtained only from crushed sclerotia. Other species of the 3 genera were isolated from surface washings only.

Fifty-five per cent of the fungal isolates, 33 per cent of the bacteria, and 21 per cent of the actinomycetes exhibited various

degrees of growth inhibition of **S. rolfsii** on Czapek-Dox agar. Growth of 5 fungal isolates was inhibited by **S. rolfsii.** Several isolates from each group of organisms either stimulated or inhibited sclerotium production by **S. rolfsii.**

Microbial Relationships and Antibiotic Effects Associated with Sclerotium rolfsii in Trifolium repens

E. A. CURL and J. D. HANSEN

Alabama Polytechnic Institute, Auburn, Ala.

Studies of the ecological relationships of the pathogen, **Sclerotium rolfsii,** and associated soil microorganisms were initiated in 1957.

A large number of diseased and healthy stolons of white clover **(Trifolium repens)** were collected from 4 experimental fields. Each diseased stolon was arbitrarily divided into 3 zones. One consisted of dead tissue, another zone was discolored tissue but not dead, and the third zone was green tissue adjacent to but visually unaffected by the disease. In the laboratory, all stolons were washed several times in sterile water on a mechanical shaker. Fungi, bacteria, and actinomycetes were isolated to pure culture from the 3 zones of diseased stolons and from cuttings of healthy stolons. Representative isolates were tested on Czapek-Dox agar for their antagonistic effects upon **S. rolfsii.**

The predominant fungi in each of the 3 zones of diseased stolons were **Fusarium** spp., species of several genera of the Mucoraceae, **Sclerotium rolfsii**, and **Trichoderma** spp. The Fusaria were more prevalent in the green zones of the infected stolons and in healthy stolons than in the dead zones and discolored zones. The other predominant fungi decreased in prevalence toward healthy tissue. **S. rolfsii** and **Trichoderma** spp. were not isolated from any of the healthy stolons. Three common plant parasitic fungi, **Colletotrichum** spp., **Sclerotium bataticola**, and **Curvularia trifolii**, were isolated from each zone. Species of **Colletotrichum** were isolated from apparently healthy stolons. Bacteria were more abundant than actinomycetes in both diseased and healthy stolons.

Fifty-three per cent of the fungal isolates, 17 percent of the bacteria, and 33 per cent of the actinomycetes were antagonistic to **S. rolfsii** in plate culture. Twenty per cent of the fungal isolates were inhibited by **S. rolfsii.** Some isolates of the 3 groups of micro-

organisms stimulated production of sclerotia by **S. rolfsii** while others inhibited production.

Control of Southern Blight of Tomato and Pepper in Alabama

URBAN L. DIENER

Alabama Polytechnic Institute, Auburn, Ala.

Experiments in the control of southern blight of tomato and pimento pepper, caused by the fungus, **Sclerotium rolfsii,** were conducted in 1953, 1954, and 1956 at the Southeast Alabama Horticultural Field near Ashford, the Chilton Area Horticultural Substation near Clanton, and the North Alabama Horticultural Substation near Cullman. Plots consisted of 10 to 15, 25, and 65 to 100 plants, respectively, for the 3 years. Treatments were randomized and replicated 4 to 6 times. Terraclor (pentachloronitrobenzene) was applied either as a 20 per cent dust mixed in the furrow at a rate of 720 pounds per 100 gallons of water and applied as a setting water treatment at a rate of about ⅓ quart per plant. Other materials, applied either as a preplanting soil amendment, drench, or setting water treatment, evaluated were captan, Dithane 20, Shell CBP and Stauffer N521.

Plot data showed that Terraclor was significantly better than other materials and consistently reduced diseased losses at all locations in most years. The setting water method gave more effective and more economical control than soil-mixing, preplanting treatments. Observations indicated that rotations also might reduce disease losses in pimento pepper and tomato plantings.

The Mycoflora of Stored Peanuts

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Farmer stock peanuts, stored in 26 bins of several different types at Headland, Alabama, were sampled randomly on June 5, 1957. These peanuts had been in storage 7, 20, 32, 44, and 55 months. Initial damage at the time of storage for the 26 lots varied from

0.0 to 5.6 per cent. Initial seed moistures varied from .6 to 15.4 per cent. Storage construction types consisted of 7 steel-tube bins, 8 steel-tight bins, 1 steel- and 6 wood-vent bins, 3 wood-tight bins, and 1 wood farmer-constructed bin.

Two independent 10-pound samples were taken with a probe from both the surface and from the middle of the bin. In the laboratory 100 gm. were riffled from each sample. Qualitiative and quantitative mold determinations were made by a method previously described (Jour. Ala. Acad. of Sci. 29: 77, 1957).

The predominant fungi were 5 species of the Aspergillus glaucus group **(A. ruber, A. repens, A. chevalieri, A. restrictus, A. amstelodami)**. Others that occurred frequently were **A. tamarii, Penicillium citrinum, P. funiculosum, P. janthinellum, Torula sacchari,** and **Candida** sp. Thirteen other species (6 of them Aspergilli) occurred less commonly. The A. glaucus group made up from 40 to 100 per cent of the mycofloral population in 45 per cent of the samples. This group was predominant or equally as abundant as another fungus in 39.4 per cent of the samples.

The mold count of samples ranged from 7 to 1,350,000 colonies/gm. of peanuts. High mycofloral counts were correlated with high initial moistures. The data showed that high mold counts associated with wood-vent bins and 20 month storage (1955) were the result of the high initial moisture in peanuts. There was no relationship of mold count to initial damage. Deterioriation in stored peanuts as measured by chemical changes has been correlated with high initial moisture. It is possible that the mycoflora is the direct cause, with high initial moisture being the indirect factor in the deterioration of peanuts in storage.

Winter Annuals

ROLAND M. HARPER

Geological Survey of Alabama. University, Ala.

In cold climates annual plants complete their life cycle between snows, and are represented in winter only by seeds. But in this latitude many annuals, mostly weeds, begin growth in the fall, stand still through the winter—commonly in the form of rosettes—bloom in spring, and disappear in summer.

Common examples observed in and around Tuscaloosa this past winter (which was colder than usual) are **Stellaria (or Alsine)**

media, various crucifers, such as **Bursa** and **Arabis, Vica angustifolia, Trifolium Carolinianum, Alchemilla multicaulis, Geranium Carolinianum, Chaerophyllum Tainturieri, Lamium amplexicaule, Veronica arvensis, Galium Aparine, Erigeron Philadelphicus, Soliva sessilis,** and **Gymnostyles nasturtiifolia.** Some cultivated plants behave in the same way.

Somewhat of an exception to this is **Lepidium Virginicum,** which lives through the summer, but has a winter blooming phase, with a crooked and somewhat woody stem. The **Lamium** has cleistogamous flowers through the winter, and conspicuous flowers in spring. The cleistogamous phase has been given a varietal name, which seems unnecessary. The winter phase of **Galium Aparine** has only six leaves in a whorl, while the spring blooming phase has seven. **Molucella laevis,** cultivated for ornament, is remarkable in that it comes from the Molucca Islands, near the equator, and one would hardly expect it to grow in this climate at all. But its seeds fall to the ground and germinate spontaneously and its leaves live through the winter, and it may be on the way to becoming a weed.

Some of these species range pretty well to the north, and it would be interesting to know what they do in winter in the northern states. There ought to be many winter annuals in California, where the winters are mild and the summers practically rainless.

Factors Affecting the Response of Zea mays to Sodium 2,2-Dichloropropionate

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Sodium 2,2-dichloropropionate (hereafter referred to as dalapon) is a selective translocated herbicide recommended for the control of several grasses. It is very good for the control of grasses with large underground rhizomes, such as Johnsongrass, **Sorghum halepense.**

Corn was used for studying this herbicide because of its genetic homogeneity, ease of growth, susceptibility to dalapon, and basic similarity to certain weed species for which dalapon is a recommended control. Varying rates of dalapon were applied to corn of different ages in the field and in the greenhouse. The response

of corn to dalapon was determined by measuring the height of the plants. Other data, such as the number and length of internodes and the number of whorls of brace roots, aided in the determination.

The data show that dalapon greatly inhibited the growth in height of corn. Analysis of variance of height data shows highly significant effects of age of corn plant and rates of dalapon. There were significant interactions between age and rates of application. Resistance to the toxicity of dalapon in the corn plant increased with age.

Natural History and Distribution of Water Mites, Genus Unionicola, in Anodonta grandis Say, Lampsilis siliquoidea (Barnes), and Ligumia nasuta (Say)

PAUL NAKANA

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This study, conducted at the University of Michigan Biological Station in the summer of 1957, was an effort to provide information concerning parasitic water mites of the genus **Unionicola** found in clams. Clams were collected in the region around Douglas Lake (Cheboygen County), and specimens collected were examined to determine the number, kind, and specific area of infestation of parasites in the clams.

From the three specimens of clams examined (**Anodonta grandis, Lampsilis siliquoidea**, and **Ligumia nasuta**), six different forms of **Unionicola** were distinguished. Clams were collected at four different sites in two different lakes. Ecological factors at each site were recorded, and an attempt was made to correlate distribution patterns of the water mites from each species of clams collected at each site.

Results of the study indicated that, of the three clams examined, **Anodonta** is the most heavily parasitized by **Unionicola**, and that **Ligumia** is apparently not infected by the water mites. Rough gills, such as found in **Anodonta**, seemed to be an important factor in determining the species of clams attacked.

Fungi Associated with Diseased Pine Seedlings in Alabama Forest Nurseries

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Diseases of pine seedlings are a serious problem in forest nurseries in the Southeastern states. During 1957, surveys to determine

the prevalence of different fungi associated with diseased pine seedlings were begun in forest nurseries near Atmore, Auburn, Autaugaville, and Childersburg, Alabama. Diseased seedlings of longleaf pine (**Pinus palustris**), loblolly pine **(P. taeda)**, slash pine **(P. elliottii)**, and shortleaf pine **(P. echinata)** were observed in the Auburn and Autaugaville nurseries. Diseased seedlings of Virginia pine **(P. virginiana)** and loblolly pine were observed in the nursery near Childersburg. Diseased slash pine seedlings were found in the Atmore nursery. Diseased specimens of each species in each locality were collected for isolation in the laboratory. Diseased tissues were surface sterilized in mercuric chloride, 1:1000, and plated on acidified potato-dextrose agar. The fungi from these cultures were isolated to pure cultures.

Sclerotium bataticola and **Fusarium** spp. were isolated from all five species of pine. **Chaetomium** sp. and **Penicillium** spp. were isolated from all species except shortleaf and Virginia pine. **Rhizoctonia** sp. was isolated from slash and shortleaf pine and **Pullularia** sp. from slash pine.

Greenhouse studies are now in progress to determine the pathogenicity of these fungi to pine seedlings. At the time of this report only **Rhizoctonia** sp. was found to be pathogenic. Inoculations of pine seedlings using **Fusarium** sp., **S. bataticola**, and **Chaetomium** sp. have so far been unsuccessful.

Some New Monogenetic Trematodes from the Gizzard Shad, Dorosoma cepedianum (La Sueur)

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Among specimens of monogenetic trematodes collected from the gills of the gizzard shad during 1938 to 1942, by Dr. Ralph V. Bangham, College of Wooster, Wooster, Ohio, at Reelfoot Lake and Norris Dam, Tennessee, were four species that appear to be new.

One of the species, represented by a single specimen, belongs to the Dactylogyridae Bychowsky. It is very close to **Actinocleidus fusiformis** (Mueller) from **Micropterus dolomieu** Lacepede, but owing to the paucity of material a description of it appears unwise at present.

The remaining three species belong in the family Mazocraeidae

Price, two to the genus **Mazocraeoides** Price, and the other to a new genus for which the name **Pseudanthocotyloides** is proposed. This genus resembles **Pseudanthocotyle** Bychowski and Nagabina except for the arrangement of the genital hooks which are in transverse rows as in **Mazocraes** Hermann, whereas, in **Pseudanthocotyle** they are in vertical rows as in **Kuhnia** Sproston. For the type, and so far the only species, the name **Pseudanthocotyloides banghami** n. g., n. sp., is proposed, the characters of the species being those of the genus.

Of the two new species of **Mazocraeoides**, one, **M. megalocotyle** n. sp., is readily distinguished from other species of the genus in having haptoral suckers or clamps more than twice the size of those of related forms. The other species, **M. similis** n. sp., resembles **M .geogei** Price and **M. opisthonema** Hargis except that the gonads are haptoral in position in these forms and largely prehaptoral in **M. similis.**

Absorption and Translocation of Radioactive Simazin by Corn, Cotton, and Cucumbers

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Simazin is a relatively new herbicide that shows great promise as a pre-emergence treatment for corn. Investigations to determine absorption routes and areas of accumulation were conducted at the A.P.I. Agricultural Experiment Station, utilizing the C^{14} labelled compound.

Corn, cotton, and cucumbers were used as test plants because of differences in susceptibility between these species. Corn is highly resistant to the chemical, cotton is intermediate in susceptibility, and cucumber is highly susceptible.

In all three plants, the herbicide was found to be absorbed by the roots of plants growing in nutrient solution and was translocated to the shoots. The activity, as determined by radioautographs, was scattered throughout the leaves of the corn plant with some increase in activity in the veins. In the cotton plant, there was an increase in activity in the lysigenous glands of the hypocotyl, cotyledons, and leaves. In cucumbers the herbicide accumulated in the leaf margins, where injury symptoms were first noted.

Comparative Effects of Ephinephrine and Norepinephrine on Peripheral Blood Cells of the White Rat

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Fifty, healthy, three month old rats of the Holtzman strain, including males (335+35 grams) and females (230+40 grams), were used in a dosage level study in an attempt to find the dosage of epinephrine and norepinephrine which had the most significant effect upon the red, white, and eosinophil counts of the white rat.

Twenty animals, divided into four groups, were used in the epinephrine experiment, in which the dosages were 25, 50, 75, and 100 mgm. of Adrenalin Chloride (1:10,000), given intraperitoneally. Base counts were taken immediately prior to the injection of the adrenergic drug, followed by counts at the 20, 40, 60, 80, 100, and 120 minute periods.

Seventeen animals, divided into four groups, were used in the norepinephrine experiment, wherein the dosages were 50, 75, 100, and 125 microgram of norepinephrine (Levophed, 0.1% base). Red, white, and eosinophil counts were taken as described in the epinephrine experiment.

Eight animals were not injected, serving as controls. Blood cell counts were made at the same time intervals as the injected groups.

Conclusions:

1. Epinephrine brought about a significant increase in the total leucocytes at the 20 and 40 minute periods, followed by a leucopenia at the 80 and 100 minute periods. The most effective dosage of ephinephrine was 75 microgram. A small rise in erythrocytes was noted but it not thought to be significant.

2. The norepinephrine effect was similar to that of epinephrine but usually not as potent. The most effective dosage of norepinephrine was 125 microgram, which brought about a significant increase in total leucocytes at the 20 minute period and held through the 40 minute period. A good rise in erythrocytes at the 20 minute period was also experienced.

3. All animals in both experiments were eosinopenic at the 120 minute period.

SECTION II

CHEMISTRY

The Effect of the Alkali Elements and Hydronium Ion as Extraneous Elements on the Flame Spectra of the Alkali Elements

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The effects of different concentrations of the individual extraneous ions were observed on four different concentrations for each of the alkali elements. These four concentrations cover the usual range found in flame spectrophotometric determinations. The spectral line intensities for the element at the lowest concentrations are affected the greatest for any given concentration of an extraneous element. The ions of smaller ionic radius as extraneous substances have the least effect on the elements and ions of the larger ionic radius as the extraneous substances have the greatest effect on the elements.

Enthalpy-Concentration Diagram System Uranyl Sulfate-Water.

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The heats of solution of uranyl sulfate trihydrate are determined and these data with the heat capacity data determined by Alley are used to calculate the enthalpies of aqueous solutions of uranyl sulfate. These enthalpies are given graphically in an enthalpy-concentration diagram for the system uranyl sulfate and water. This diagram covers a concentration range of 0 to 25% and a temperature range of 30 to 90 degrees centigrade.

A unique method for determining heats of solution in a calorimeter with no external opening is presented. To check the accuracy of this method the heats of solution of anhydrous sodium carbonate were determined and checked with those values found in the literature.

The heats of solution of sodium carbonate, both literature balues and those experimentally determined, are presented in graphical form, along with the heats of solution of uranyl sulfate trihydrate and the enthalpy-concentration diagram for the system uranyl sulfate and water.

The Electronegativities of the Group Va Elements

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Using available thermochemical data as well as covalent radii values, the electronegativities or stability ratios of V, Nb and Ta are approximated and employed to explain certain comparative chemical characteristics of this family.

A Study of the Gallic Acid Complexes of Niobium, Tantalum, Titanium and Iron

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A spectrophotometric study was made of the gallic acid complexes of niobium, tantalum, titanium and iron. The strongest absorptivity for the niobium complex was at pH of 7.0 and 385 mu; tantalum, pH of 4.4 and 390 mu; titanium, pH of 6.5 and 410 mu; and iron, pH 7.0 and 520 mu. Above pH of 8 the solutions became dark and turbid. The absorption bands overlapped so that any one of the elements would interfere with a spectrophotometric procedure for any other element of this group. Sodium sulfite was an excellent color stabilizer.

The Determination of Hyaluronic Acid in Synovial Fluid

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Hyaluronic acid, the substance which gives lubricating properties to join fluids, is a polymer of alternating anhydro residues of N-acetyl-glucosamine and glucuronic acid. Its determination may be based upon precipitation of the intact molecule or upon analysis of either of the two component monomers.

Other observers have favored the measurement of glucosamine.

Data will be presented in the present paper to show that Dische's carbazole method for uronic acid can be satisfactorily applied to fractions of synovial fluid. Analysis of the glucuronic acid moiety consumes far less time than does the analysis of the glucosamine moiety.

This work was supported by U. S. Public Health Service Research Grant A-1225.

Syntheses in the Quinoline Series: Some Derivatives of 6-Chloro-8-ethylquinoline.

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6-Chloro-8-ethylquinoline was obtained from 4-chloro-2-ethylaniline by means of a modified Skraup reaction and some derivatives were prepared. Chlorination of 2'-ethylacentanilide gave 4'-chloro-2'-ethylacetanilide which was hydrolyzed to 4-chloro-2-ethylaniline. The structure of 4-chloro-2-ethylaniline was verified by nitrating to yield 4-chloro-2-ethyl-5-nitroaniline, which was in turn converted into 3-chloro-4-nitrobenzoic acid. An authentic sample of 3-chloro-4-nitrobenzoic acid was prepared by a similar sequence of reactions from 4-chloro-2-methyl-5-nitroaniline for comparison purposes.

The structure of 4'-chloro-2'-ethylacetanilide was further corroborated by changing it into 2,5-dichloroethylbenzene, which was oxidized to 2,5-dichlorobenzoic acid for identification. An authentic sample of 2,5-dichlorobenzoic acid was obtained from 4-chloro-2-methylaniline by a similar sequence of reactions.

6-Chloro-8-ethyl-5-nitroquinoline resulted from the nitration of 6-chloro-8-ethylquinoline and also from 4-choloro-2-ethyl-5-nitroaniline by aplication of modified Skraup conditions. Since the structure of 4-chloro-2-ethyl-5-nitroaniline was deduced as indicated above, and since ring-closure on 4-chloro-2-ethyl-5-5nitroaniline by the modified Skraup procedure could occur in only one direction with respect to the amino grouping without causing elimination of the ethyl grouping, the demonstrated identity of the two samples of 6-chloro-8-ethyl-5-nitroquinoline as prepared by the two different procedures served to indicate that 6-chloro-8-ethylquinoline nitrated predominately in the 5-ring position.

The nitration of 2,6-dichloro-8-ethylquinoline as obtained from 6-chloro-8-ethylquinoline via 6-chloro-8-ethyl-1-methyl-2-quinolone gave 2,6-dichloro-8-ethyl-5-nitroquinoline. 6-Chloro-8-ethyl-5-nitroquinoline was also converted into 2,6-dichloro-8-ethyl-5-nitroquinoline, and this study served to verify the structure of the product obtained by the direct nitration of 2,6-dicholo-8-ethylquinoline.

Hydrolysis of 2,6-dichloro-8-ethylquinoline and 2,6-dichloro-8-ethyl-5-nitroquinoline yielded the coresponding 2-hydroxyquinolines respectively.

6-Chloro-8-ethyl-5-nitroquinoline and 2,6-dichloro-8-ethyl-5-nitroquinoline were reduced to the corresponding amines and some derivaties of these amines were prepared.

Variation of Dielectric Constant with Temperature for Some Five and Six Carbon Ketones

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The dielectric constants for a series of five and six carbon ketones were determined over the temperature range of 20°C. to −30°C. and frequency range of 3 to 25 mc. with a non-inductive type capacitance cell. The cell was calibrated with known compounds that showed no frequency dispersion over this range. The dielectric constant values were static with respect to this frequency range but varied inversely with temperature. This inverse variation was linear for the cyclic ketones and a log function for the acyclic ketones.

SECTION V

PHYSICS AND MATHEMATICS

The Howard College Cyclotron
(A Progress Report)

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The cyclotron at Howard College is a unique machine in that it is primarily a teaching tool. Its success as an educational aid is manifested by the fact that every graduate of Howard College in the field of physics since the advent of the cyclotron has either completed a graduate degree or is presently in graduate school.

The major components have been assembled but the cyclotron may be considered only half complete. Since the Van de Graff accelerators can reach the 4 mev energies expected from this machine its future usefulness seems to be in the field of radiation studies.

Graphical Constructions for Simple Lens Image Location

E. SCOTT BARR

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Current elementary physics texts seem never to mention more than one system of graphical construction for the location of images formed by simple lenses. This system can not be applied directly to the case where the source is a point on the principal axis. However, in some of the older physics texts may be found illustrations of other procedures which through desuetude have now possibly acquired novelty and for that reason are presented here.

The modification in construction which must be made when object and image are in separate media bounded by a spherical surface will be touched on.

Also not so well known as would be desirable are the Gullstrand and Newton formulations of the first order equation. The advantages of these versions will be briefly mentioned.

A Model to Show Light Curves of Eclipsing Binaries For Elementary Astronomy Classes

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A model of a binary system consisting of two diffuse lamps in rotation can simulate the main features of the light curves of eclipsing binaries. The illumination from the model is received on a photocell and the amplified output is recorded on a chart. The positions, size, shape, and brightness of the two lamps are adjustable. Elliptical orbits are simulated by displacing one lamp slightly from the center of the circle described by the other lamp. Effects of tidal ellipticity and limb darkening can also be shown. The eclipses can be total, partial, or annular.

Suggestions for Experiments Designed to Measure the Absolute Velocity of the Earth

NIELS ENGEL

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The mathematical formulas adopted in the Theory of Relativity shows that the Michelson-Moreley experiment is unsuited to measure any velocity, relative or absolute. Velocities must be measured by other methods. To measure the absolute velocity at least two bodies moving with different velocities must be used. Different physical effects may be applied.

1. The Clock Type Experiments

Measuring the proportion of clock speeds on two differently moving bodies yields one equation; measuring the relative velocity between the same bodies yields another equation; from which equations the absolute velocities of both bodies can be calculated.

Substituting lengths or masses for clock speeds yields equivalent theoretical possibilities.

2. Spinning Wheel Type Experiments.

The forward moving half of a spinning wheel in a moving space ship will be heavier and the backwards moving half will be lighter

causing a transverse effect on the spinning wheel. The earth may be considered as the space ship and the transverse force measured. From this measurement the absolute velocity of the Earth can be calculated.

3. The One Way Measurement of the Velocity of Light.

Michelson stated that it always takes the same time for a light signal to go and return. This statement does neither prove that the go-time equals the return-time nor that the velocity of light is constant.

The one-way velocity may be measured by emitting an electromagnetic wave to two distant receivers from a stationary oscillator. Another moving oscillator of the same frequency emits a signal to the same two receivers. The two signals are mixed in a phase analyzer and the beats counted. The difference in counts indicates the absolute velocity of the stationary oscillator.

Latin-American Mathematical Publications

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There are several journals devoted to mathematics published in Latin-American countries. Mathematical research papers are also published in other scientific journals and Revistas of Latin-American universities. Papers published include those presented by Latin-American mathematicians as well as those sent to the journals for publication by mathematicians of other countries.

Corrections For Two Mathematical Papers

ROLAND M. HARPER

University, Ala.

At the 1956 and 1957 meetings of the Academy I spoke to the Physics and Mathematics section about curves. and exhibited instruments I had made to draw some little-known kinds of curves. While working up the papers I had consulted the Encyclopaedia

Britannica article on Curves, a few text-books, old and new, and a few mathematicians, some in person and some by correspondence. But all those sources of information were not quite adequate, and I have since discovered a few omissions.

In the one on ovals and related curves, for the 1956 meeting (Journal, 28:115) I called one of the curves that might be traced by a point on the driving-rod of a steam engine, extended backward, a "deltoid," from its resemblance to a letter D. I have since learned that the same name had been given long before to a very different curve, called in the Encyclopedia Britannica a tricuspid. So my name is what the botanists and zoologists would call a homonym, and the curve needs a new name. Perhaps "D-shaped curve" would suffice for the present, for it is much more like our D than the Greek symbol for delta.

In the one on more curve-drawing instruments, for the 1957 meeting (Journal, 29:62) I described and figured an instrument for drawing ellipses, limacons, etc. that I had read about long ago, but could not remember a name for, or find anybody else who remembered it. One of my correspondents now tells me that it is the trammel of Archimedes (who lived in Sicily in the 3d century B.C.). Consulting a dictionary then I found it figured, and also called an ellipsograph. But my instrument has two attachments that Archimedes probably never thought of, for orienting the curves at different angles. And Archimedes probably never realized that his trammel could be turned over and used to draw limacons, for the limacon was not invented until the 17th century A.D.

The Effects of Inhomogeneous Compression on the Nuclear Quadrupole Resonance of $NaC10_3$

D. L. HOLLIS

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Previous workers have examined the effects of inhomogeneous compression on nuclear quadrupole spectra at pressures up to 140 kg/cm^2 during the application of pressure. This investigation extended the pressure range up to 7180 kg/cm^2, and observation was made after the application of pressure. Attenuation of the amplitude of the quadrupole resonance was observed with increasing pressure, and at 7180 kg/cm^2 the signal amplitude was 62% of the

amplitude of unpressed sample. The most intensive study was made on $NaClO_3$. It was compressed into pellets of one-half inch diameter by a hydraulic press, and then placed in the rf coil of a self-quenching superregenerative spectrometer. Due to the inherent inability of this type of spectrometer to reproduce accurately the line shape of the resonance, little information was obtained concerning the line width or shape. There was an indication, however, that the line width increased with increasing pressure. The decrease in amplitude was attributed to broadening of the line with the integrated intensity remaining constant. The broadening is probably due to distortion of the electric field gradient at the chlorine nucleus resulting from disturbance of the cubic symmetry of $NaClO_3$ crystals because of the applied pressures.

Paramagnetic Resonance in X-Irradiated Potassium Chlorate*

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The paramagnetic resonance spectrum of X-Irradiated Potassium Chlorate has been observed. Four groups of strongly orientation dependent lines have been found which appear to be due to the interaction of an unpaired electron with the chlorine nucleus. These hyperfine lines have an overall separation which changes from a minimum near zero to a maximum of approximately 250 gauss as the crystal is rotated. The g values of the interacting electron lies near 2.01 and has a small anisotrophy. A strong single line with a g value near 2 is also observed. This line is believed to be due to an electron trapped in an ion vacancy.

*This work suported by the Office of Ordnance Research and the Research Committee of the University of Alabama.

Physics and Textiles

JOHN MILES

Chemstrand Corp., Decatur, Ala., and Athens College, Athens, Ala.

A general account is given of the applications of physics to the problems of the textile industry which include the determination of the performance in end use of yarns, cords and fabrics, the rela-

tionships between fiber and fabric properties, the processing of fibers into yarns and yarns into fabrics, and the relationships between the mechanical behavior of fibers and their molecular structure and arrangement. Applications of the techniques of physics such as x-rays, infrared and refraction measurements as analytical tools are described. As illustrative examples, two specific applications of physics are described in some detail.

The Effect of Temperature on Photomultiplier Response*

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Gamma ray spectroscopy provides a direct correlation between photon energy and pulse height by virtue of the energy sensitivity of the scintillation counter. The pulse height and resolution of such a spectrometer depends on the temperature of the phosphor and photomultiplier.

The problem undertaken in this experiment was the determination of the response of a DuMont 6292 photomultiplier and a NaI (Tl) phosphor over a range from below 0°C to well above room temperature. The measurements include the overall effect on the phosphor and the photomultiplier together, and the effect on each one separately when connected by a lucite light pipe.

The calibration equipment consists of a linear amplifier, a differential pulse height analyser, and a scaler. High voltage for the photomultiplier is obtained from a regulated power supply. The mean height of the Cs^{137} photopeak has been chosen as the energy standard.

A thermostatic box was designed and built to provide a constant temperature environment with a narrow range of deviation from the desired temperature. Temperature control is effected by the use of a thermistor bridge circuit.

*Supported by Alabama Academy of Science grant.

SECTION VIII

SOCIAL SCIENCES

The Ride That Saved A City

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In the spring of 1863 the commander of the Union Army of

Tennessee decided on a bold move of grand strategy which might force the Confederate general Braxton Bragg to abandon Chattanooga. Colonel Abel D. Streight was to lead a select, mounted force of 2,000 men across northern Alabama to Rome, Georgia, destroying foundries, machine shops, war industries and supplies and cutting the vitally important Western Atlantic Railroad between Atlanta and Chattanooga.

On May 2, 1863, Colonel Streight's forces reached Black Creek, to the west of Gadsden, and set fire to the bridge. The Federal raiders must have a few days rest or they were doomed. If Forrest could be delayed at Black Creek—because the bridge was burned—Streight's men could find a little rest.

Emma Sansom was the first factor in the failure of Streight's plan.

Now Streight must cross the Oostanaula at Rome, then burn the bridge and commit wholesale destruction of military supplies and rail transportation. That Colonel Streight was completely frustrated in this objective, and compelled to surrender his entire force to General Forrest, was largely due to John W. Wisdom, a resident of Gadsden.

When Wisdom learned of the raiders he began his historic ride from Gadsden toward Rome by the most direct practical route. Wisdom arrived in Rome a few minutes before midnight, having ridden the sixty-seven miles in eight and an half hours. Wisdom rode five horses and one mule, and was the first to bring news of the danger to the Romans.

Being forewarned, the Romans set up the appearance of a strong defense. An advance guard of the raiders reported that Rome could not be seized; whereupon, Col. Streight surrendered 1466 men to Forrest's 410.

The paper ends with a comparison of Paul Revere of Boston and Paul Revere of Alabama, much to the favor of the latter.

Can Unions Organize Branch-Plants in the South?

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One of the factors which may influence the outcome of a union membership drive is the structure of the company being organized. The present study strives to determine whether or

not unions have been more successful in organizing the plants of single-plant firms than those belonging to multiple-plant firms in the South.

To answer this question, the study draws on data collected in three questionnaire surveys of Southern firms scattered from Maryland to Louisiana. In all, 664 plants employing nearly one-half a million workers are included in the investigation.

The procedure employed in the study is to compare the extent of unionization in single-plants and in branch-plants grouped variously so as to achieve increasing levels of comparability between the plants being contrasted. The criteria used in classification are industry group, industry, plant size, location of company headquarters and the use of an organized personnel department and/or full-time personnel workers (called "personnel specialization" in the paper.) The differences in extent of unionization revealed in these comparisons of single-plants and branch-plants have been tested by the use of chi square to determine whether or not they are statistically significant at the five oı ten percent level of confidence.

When all single-plants are compared with all branch-plants, the extent of unionization is found to be significantly greater in the branch-plants. Similar significant differences are found for five of eight industry groups, when the plants are so classified. As the plants are further classified and reclassified to achieve higher levels of comparability a remarkably consistent picture emerges. In all but two sets of comparisons, one involving individual industries and the other industry groups, the extent of unionization is greater in a majority of the cases in branch-plants than in single-plants, though the degree of difference appears to decline as the degree of comparability of the plants contrasted increases.

This analysis suggests that of any large group of Southern plants selected at random a substantially higher proportion of the branch-plants than of the single-plants would be unionized. This difference would be attributable largely to differences in industry, size, personnel specialization and the location of company headquarters, but also in part to differences in company structure.

Birth Control Practices in Selected Roman Catholic Countries

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In each of the Roman Catholic countries studied the Church position toward birth control and contraceptives was found to be the same. With regard to the practices and attitudes of the members of the Church in various countries very little information was available wih the exception of Puerto Rico. Part of the reason for the lack of information is the position of the Church which is instrumental in establishing laws prohibiting not only the dissemination of contraceptives, but also discussion of them.

It was found that the Church position is an important influence upon the methods of birth control practiced, and upon the attitudes of the people toward contraceptives. However considerable variation was noted among the countries studied.

Several factors seem to be important in explaining variations among the countries. The very devout Church members abide by the teachings of their religion and do not use artificial methods for preventing conception, but are likely to use such methods as continence, coitus interruptus and the rhythm method.

The less devout, depending upon their knowledge and the availability of artificial devices, are more likely to use the artificial as well as other methods of conception prevention. They also commonly resort to sterilization and abortion.

There is a tendency for persons in the upper classes and in the urban areas to practice some form of birth control to a greater extent than persons in the lower classes and in the rural and underdeveloped areas. There seems to be a general desire on the part of persons in most of the countries studied to want a limited number of children, usually fewer than they actually have.

SECTION IX
MEDICAL SCIENCES

Problems in Locating the Site of Action of Vitamin C

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Serum patterns and weight curves of guinea pigs will be shown to illustrate conditions which are found in scurvy but which probably result from secondary causes.

The weight loss curves in the terminal stage of vitamin C deficiency in guinea pigs are frequently like those of starved pigs receiving adequate vitamin C. The deaths of the majority of scorbutic casualties actually appear to result from starvation rather than directly from a lack of the vitamin. Yet, many observers have reported uncritically findings in animals that have lost much weight, attributing them all to the lack of the vitamin. The secondary contribution of hemorrhagic wounds is also seldom weighed. The result is a conflicting literature.

Diminution of these secondary factors seems possible of achievement through a selection of shorter experimental periods and of only guinea pigs which eat heartily.

This work was supported by Hoffman-La Roche, Inc., Nutley, N. J., and by U. S. Public Health Service Research Grant A-1225.

Jerome Cochran: The Guiding Genius in Public Health Legislation in Alabama

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Dr. Jerome Cochran, a Confederate Army veteran, was located in Mobile in 1865 when he was 34 years old. When the Medical College reopened in 1868, he was appointed Professor of Chemistry. In 1875, he was appointed Professor of Public Hygiene and Medical Jurisprudence, a position which he held until 1877. From 1870 until his death in 1906, his chief efforts and studies were directed toward public hygiene and especially toward bettering laws reg-

ulating sanitary matters and the practice of Medicine in Alabama. Much of that which appears in the statutes of the state today in relation to public health and medical practice is his handiwork.

Dr. Cochran wrote a new constitution for the State Medical Association in 1870 and it was adopted at the Tuscaloosa Meeting in 1873. He formulated a plan in 1872 for organizing a State Board of Health and it was enacted into law by the General Assembly in 1875. In 1879, the Medical Association elected him as the First Health Officer of the State, a position he held for 27 years. Dr. Cochran's fine command of the English language is attested by the impressive and extensive list of papers which he wrote. Many of these appeared in the State Transactions. In 1898 the State Association President Luther L. Hill recommended establishing the "Jerome Cochran Lecture" to be given at each future annual meeting of the Association. The first lecture was delivered the next year and the list of Jerome Cochran Lectures includes medical men not only from Alabama but also some of the most renowned physicians this country has produced.

Tissue Reaction to Synthetic Arterial Grafts

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Plastic tubes of polyethylene, silicone rubber, and fabric tubes of nylon and Teflon have been inserted as arterial substitutes in experimental animals. Tissue reaction, lining with "new intima," causes of clotting and ability to flex without kinking have been carefully studied, and the findings applied to human arterial diseases.

Action of Desalting by Electrodialysis on Thyroxine and Other Iodinated Compounds

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The electrolytic desalter devised by Consden, Gordon and Martin uses a DC current to reduce inorganic cations, which form an amalgam with the mercury cathode. Anions migrate through the

cellophane membrane toward the anode and are removed by a flow of electrolyte. Organic compounds, such as amino acids, are retained in the cathode compartment, and the technique is widely used to remove inorganic salts from urine samples prior to chromatography. Our interest in the apparatus arose from a need to desalt Ringer solution used as incubation medium for kidney slices in contact with thyroxine and its analogs, as well as other, non-iodinated amino acids.

Desalting of Ringer solution containing thyroxine, 3,5,3,-triiodothyronine or 3,3,-diiodothyronine resulted in deiodination to thyronine. There was no loss of thyronine when this compound was present from the start. 3,5-Diiodothyronine yielded an unknown deiodinated product showing positive ninhydrin and Pauly reactions. 3-Monoiodotyrosine and 3,5-diiodotyrosine both were deiodinated to tyrosine. The thio-ether analog of thyroxine, O-methyl thyroxine and thyroxamine were all deiodinated, but we do not have the corresponding reference substances for definite identification.

Some differences appear in the fatty acid anolog series: tetraiodothyro-acetic, -propionic and -acrylic acids lose iodine more slowly than thyroxine and more slowly than the corresponding triiodo- and diiodo-derivatives. In contrast, tetraiodothyroformic acid was not only completely deiodinated, but left no identifiable phenolic compound. Several other types of organic iodine-containing substances also lose iodine more or less completely. Obviously, this desalter cannot be used to eliminate inorganic ions when there is iodinated organic material present, if the latter is of any interest. (Supported by grants from the American Cancer Society and the United States Public Health Service.)

The Effects of Therapeutic Doses of Salicylates on Adrenal Cortical Secretory Activity in Normal Subjects*

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The similar therapeutic effect obtained from salicylates and

glucosteroid therapy in rheumatic diseases has led to speculation that their mode of action is similar, possibly that salicylates increase adrenal cortical activity. Several studies have been undertaken to delineate this, but the reported results remain controversial. The present study is an attempt to determine whether salicylates in moderate therapeutic doses alter the 24-hour urinary excretion of adrenocortical metabolites.

A group of 10 healthy individuals, while performing their usual daily activities, were studied. There were 6 males and 4 females, with ages ranging from 23 to 50, with a mean of 37 years. Salicylates were given orally as aspirin in doses of 2.6 gms daily in 4 divided doses for a period of 4 days. Twenty-four hour urine specimens were collected from 7:00 A.M. to 7:00 A.M., for 2 days prior to the institution of salicylate therapy on the last 2 days of treatment. Duplicate determinations of creatinine, 17-ketosteroids and 17-hydroxycorticosteroids were carried out on each specimen. All of the control and treatment urinary steriod values were within normal range, as obtained in our laboratory. There were no significant differences beween the control and treatment urinary 17-ketosteroid levels which were 14.9 mgs before and 14.6 mgs per 24 hours during salicylate therapy. Similarly there was no significant difference between the mean urinary 17-hydroxycorticosteroid levels obtained during the control and treatment periods. The mean value for the pre-treatment period was 5.8 mgs and for the treatment period 5.5 mgs per 24 hours.

It would appear that salicylate administration in this dose range does not consistently influence the urinary excretion of these 2 adrenal cortical metabolities.

* Aided by a grant from The National Institute of Arthritis and Metabolic Diseases, National Institutes of Health.

Electrophoretic Studies of the Mucin Clot from Human Synovial Fluid

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One of the properties of synovial fluids is the formation of a clot when weak acids are added. The physical character of this clot has been used in differentiating pathological synovial fluids from normal synovial fluids.

Electrophoretic studies by previous workers have shown the mucin clot to be composed of hyaluronic acid and protein (cattle mucin); hyaluronic acid, albumin and gamma globulin (horse and human mucin); hyaluronic acid or complex, albumin and other proteins (cattle mucin).

The investigation described here was carried out to determine the differences in the components present in the mucin clot from human normal and human pathological synovial fluids. All clots were found to contain albumin and hyaluronic acid. Arthritic clots often had small amounts of alpha or beta globulins. The hyaluronic acid may exist in the form of a complex with protein, but this seems unlikely.

An Attempt to Identify the "Rheumatoid Factor" in Serum of Members of Families of Patients with Rheumatoid Arthritis*

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The known hereditary trait in rheumatoid arthritis, together with reports of an abnormal globulin in the serum of these patients early in the onset of the disease, has resulted in speculation as to whether this factor represents the common denominator in patients with the disease and those with predisposition for development of the disease. It appeared to be of interest to determine whether this "rheumatoid factor" could be identified in members of a patient's family. Using a potentiated method, i.e., isolation of the euglobulin fraction for demonstration of the agglutinating factor with sensitized latex particles, as outlined by Singer and Plotz, we have examined the sera obtained from the siblings and offsprings of 8 patients with peripheral rheumatoid arthritis. These patients fulfilled the criteria, both clinically and serologically, for the diagnosis of the disease. In no instance was the "rheumatoid factor" demonstrated. These findings are not compatible with previously reported data.

* Aided by a grant from the National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, United States Public Health Service, Bethesda, Md., and the John R. Irby Fund for the Study of Arthritis.

Evaluation of Renal Function in Adrenalectomized Dogs

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Although the disturbances in fluid and electrolyte metabolism which follow adrenalectomy are well known, it is still uncertain whether the kidney or some extra renal factors are responsible for these abnormalities. In these experiments, adrenalectomized dogs were maintained on cortisone or hydrocortisone and renal function studies were made at various times after the withdrawal of replacement therapy. Glomerular filtration rate and the excretion of various electrolytes was measured, as well as bromide space. In severe adrenal insufficiency, glomerular filtration rate is greatly reduced, and some of the changes are comparable to those occurring after nephrectomy. It is suggested that adrenal insufficiency results in a generalized metabolic disturbance which probably alters electrolyte distribution throughout the body. Its effect on renal function is probably of the same nature and results in a nonspecific type of renal failure.

An Evaluation of the Clinical Use of Newer Serological Diagnostic Procedures in Rheumatoid Arthritis*

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The tests currently employed in the serological diagnosis of rheumatoid arthritis are the latex fixation test using whole serum and the extracted euglobulin fraction, and also the Bentonite flocculation test.

These procedures are predicted on the presence in the blood of patients with rheumatoid arthritis of a so-called "rheumatoid factor" which is capable of causing agglutination of the test materials.

It was deemed of interest to determine the relative efficiency of these tests in correlation with the clinical diagnosis of rheumatoid arthritis. The latex fixation procedure using whole serum has

shown a very good correlation with clinical diagnoses. Preliminary results have shown that using the euglobulin fraction results in an increased sensitivity. Tests using the euglobulin fraction have resulted in obtaining 5 positive tests on previously latex negative patients, thereby indicating the sensitivity potentiation value of this method. The study will be extended and the data obtained will be presented.

* Aided by a grant from the National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, United States Public Health Service, Bethesda, Mr., and the John R. Irby Fund for the Study of Arthritis.

Effect of Pyridoxal Phosphate on the Maintenance of Rat Kidney Cortex Oxygen Consumption

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Rat kidney slices in Krebs' Ringer glucose with either DL-alanine or L-proline consumed oxygen at almost the initial rate after three days incubation at 5°C in the presence of b-thyroxine compared to about 10% of the initial rate without thyroxine. Out of a series of fifty other amino acids and related compounds tried, N-acetyl-DL-alamine was the only compound which allowed so good a maintenance of oxygen consumption in the control or in the presence of thyroxine as alamine or proline.

The addition of 83.3 microgram of pyridoxal phosphate per ml. of medium produced better maintenance of oxygen consumption in the control tissue but had no effect in the presence of thyroxine. Although the effect on the control tissue has been variable, oxygen uptake in several experiments has been maintained nearly as well as with thyroxine.

Preliminary results indicate that the amount of keto acid present in the medium after incubation with thyroxine is 45% less than the amount found in the controls. The controls with pyridoxal phosphate present had a keto acid level 25% lower than the controls without pyridoxal phosphate. These data indicate that thyroxine and pyridoxal phosphate either depress the formation of monocarboxylic keto acids or increase their utilization.

Supported by grants from the American Cancer Society and the United States Public Health Service.

Studies On Synovial Permeability Using Radioiodinated Human Serum Albumin

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Data on the permeability of the synovial membrane have been derived from experiments involving the measurement of the disappearance of certain ions (sodium, potassum, iodide), dyes (phenolsulfonphthalein), and radiopaque substances (Diodrast, Neo-Iopax) from the joint cavity. These may or may not reflect the permeability characteristics for protein fractions. Immunological methods have been used to demonstrate the route of disappearance of proteins from the knee joint space. It seemed of interest to investigate a quantitative approach for assessing synovial permeability by employing isotopically labeled serum proteins. Commercially available radioactive iodinated (I-131) human serum albumin was used in this study.

Fourteen patients with rheumatoid arthritis and two patients with hydrarthritis were injected (affected knee joint) with the tagged protein. Prior to the injection, the subjects were placed on Lugol's solution to achieve thyroid blockage. Serial blood samples were taken, and counted in a gamma-sensitive scintillation well counter. Blood volumes were determined at the end of the 48th hour with an intravenously injected quantity of the tagged material. From (1) the activity injected into the knee joint (9.2 microcuries); (2) the activity in the serial blood samples; and (3) the total circulating blood volume, the tagged protein in the circulation was estimated. In addition, at the 24th hour, counts were taken over the injected knee and compared to the knee injection standard, thus an expression of the per cent remaining in the knee was obtained.

In untreated subjects, from 9% to 18% of the injected material was in the circulation of the 4th hour. In patients undergoing steroid or heavy salicylate therapy less than 5% of the tagged protein was in the circulating blood at this time. At the 24th hour, 44% to 58% of the radioactivity remained in the knee in the treated group, whereas, from 24% to 37% remained in the knee joint space of the untreated subjects.

Variation in Mineral Metabolism Among Subjects Receiving a Constant Intake

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Six college women were subjects for a study to obtain more information on range of normal metabolic response to eight nutrients in a standardized diet. A 5-day period on a self selected diet was followed by 15 days on the control diet. Among the eight nutrients under study were calcium, phosphorus and magnesium. There was a wide variation, both in urinary and fecal mineral excretion among these subjects while on the standardized diet. Variation in retention was not related to pathway of excretion of these minerals. There was, however, a similarity in pattern of retention of the three minerals for the individual subject. Differences in mineral retention among these subjects were not related to age, height, weight, or basal oxygen consumption. (Supported by a U.S. Dept. of Agriculture contract, sponsored by the Human Nutrition Research Division, Agricultural Research Service).

Bovine Submaxillary Mucin

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The composition of bovine submaxillary mucin has received some earlier investigation by Blix, K. Meyer and Gottschalk. They have studied especially the structure of its constituent sialic acid. However, the earlier data concerning the nature and quantity of components in the mucin are not consistent.

In the present work, the purification of bovine submaxillary mucin has been followed by determinations of the electrophoretic mobility, the sedimentation constant and changes of viscosity. Several mucin preparations have been analyzed chemically to determine the nature of the components. However, the present products are apparently not yet homogeneous.

Factors Affecting Blood Oxidation-Reduction Potentials

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In studying the oxidation-reduction potentials of dog's blood it was noticed that there was considerable variation in the potential readings. A series of experiments were then performed to determine some of the factors which affect the oxidation-reduction potential of blood. In one series of experiments venous dog blood was divided into three aliquot samples in separatory funnels. One sample was gassed with oxygen, one with air and one with prepurified nitrogen. Samples of each treated blood were then removed and the oxidation-reduction potentials measured under anaerobic conditions by means of a Beckman Model G pH Meter. The blood treated with oxygen had the most oxidizing potential, the air-treated blood a less oxidizing and the nitrogen-treated blood the most reducing potential. In another series of experiments samples of arterial and venous blood were taken from the same dog and tested under anaerobic conditions. The arterial blood was on the average about 50 millivolts more oxidizing than the venous blood. Still other experiments indicated that successing readings on the same blood sample showed consecutively more reducing potentials, that successive samples of blood from the same anesthetized dog have more and more reducing potentials and that samples of centrifuged cells show a more reducing potential than does the supernant plasma. These results indicate that the more oxygenated the blood the more oxidizing the potential, as would be expected. They also indicate that considerable caution must be exerted in obtaining and interpreting oxidation-reduction potentials of blood. The control of the blood temperature and anaerobic conditions at the time of the reading, the amount of anesthesia of the dog, whether arterial or venous blood is tested and other factors still unknown are all important in obtaining valid and consistent oxidation-reduction potential readings.

Studies on Carbohydrate Metabolism of Kidney Tissue

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Gluconeogenesis by rat kidney has been demonstrated *in vivo* and *in vitro*, but the role of glucose in kidney carbohydrate metabolism is obscure.

Incubation of rat kidney cortex slices in Ringer-phosphate solution containing glucose up to 1000 mg.% has resulted in a maximum uptake of only 100 microgram per 100 mg. of tissue. This small amount might well be accounted for on the basis of adsorption of a small volume of the glucose-containing incubation medium. Addition of insulin to the medium had no influence on glucose uptake. Application of these conditions of incubation to excised rat diaphragm resulted in considerable uptake of glucose and storage of glycogen, especially when tissue from young animals was used.

Intravenous infusion of a concentrated glucose solution into anesthetized rats resulted in a marked increase in kidney glucose content along with the elevated systemic blood sugar level, but no significant glycogen formation. When thin slices were prepared from these kidneys and rapidly rinsed 4 times in cold Ringer, 55% of the tissue glucose was removed. Incubation of the kidney slices with Ringer solution in Warburg vessels at 37°C resulted in removal of 94% of the tissue glucose in 15 minutes.

It is clear that kidney cortex has a very limited ability to retain glucose and to store glycogen.

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Application of "Latex Fixation" Test to Spinal Fluid of Patients with Rheumatoid Arthritis*

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Patients with rheumatoid arthritis show an abnormality in the serum proteins, characterized by an increase in the gamma

globulin fractions. Likewise, similar alterations occur simultaneously in the synovial and spinal fluid. The gamma fraction of the serum and synovial fluid has been shown to contain a hemoagglutinating substance, the so-called "rheumatoid factor." A study was undertaken to determine whether this factor could likewise be identified in the cerebrospinal fluid in patients with peripheral rheumatoid arthritis.

Using the sensitized latex particle test for the rheumatoid factor, as described by Singer and Plotz, spinal fluid was examined from eight peripheral rheumatoid arthritics who were found to have a high titered latex fixation test in the serum; seven samples from patients with rheumatoid spondylitis, and one from osteoarthritis were used as controls. The test gave negative results in all the samples studied. It can be concluded that the protein that makes up the rheumatoid factor is probably of high molecular weight and does not pass the blood brain barrier.

*Aided by a grant from the National Institute of Arthritis and Metabolic Diseases, National Institute of Health, United States Public Health Service, Bethesda, Md., and the John R. Irby Fund for the Study of Arthritis.

D-Amino Acid Oxidase and L-Glutamic Acid Dehydrogenase Contents of Tetrahymena pyriformis Y at Two Phases of Growth

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Bacteria-free cultures of *Tetrahymena pyriformis* were grown in modified Phelps medium. Cells were harvested by centrifuging and washing during two phases of growth, the logarithmic and stationary.

Homogenates of these cells were assayed for two enzymes by the authors' microdiffusion methods. No D-amino acid oxidase activity was found; six assays were made on four separate cultures.

L-glutamic acid dehydrogenase was found to be present and active in the protozoan cells; nine separate cultures were assayed. On a cellular basis, the cells from mature cultures contained more enzyme than did those from logarithmic cultures; but enzymatic activity per milligram of total nitrogen did not differ significantly

in the comparison of cells in the two stages of growth. These results indicate that the termination of cellular multiplication is not necessarily accompanied by a change in physiological state of the cells.

Micromethods for Assay of L-Glutamic Acid Dehydrogenase and D-Amino Acid Oxidase in Animal Tissues

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By adopting the procedure of the Seligsons for the measurement of ammonia by diffusion, micromethods have been developed for two enzymes. The components of the system for L-glutamic acid dehydrogenase include: (volumes in microliters) 5% tissue homogenate, 10-100; 0.3% DPN, 100; "coenzyme factor" of Dewan and Green, 30; 3% methylene blue, 20; M/3 L-glutamate, pH 7.3, 50; water to make final volume 300. The mixtures are contained in pencillin bottles, incubated at 37° for 20 min., made alkaline with potassium carbonate, and rotated for 1 hr. The ammonia is trapped on glass rods, inserted through the stoppers and dipped in 1N sulfuric acid. The ammonia is determined by Nesslerization and comparison with a nitrogen standard, using a Klett-Summerson photometer with 420 filter. Blanks are made on the system containing no tissue, and corrections applied. Homogenate of liver, kidney and brain of both rats and mice have been assayed by this procedure, and the results compare favorably with values reported in the literature obtained by us of methods requiring larger volumes of homogenate.

The system for D-amino acid oxidase contains: 16% tissue homogenate, 10-150; 0.1 M veronal buffer, pH 8.5, 100; 0.3 M DL-alanine, pH 8.5, 50; water to make final volume 300. Incubation and determination of ammonia follow as above. This assay has been tested on homogenates of liver and kidney of rats and mice.

In both methods, responses are linear and sufficiently large that the methods can be used for assay of relative enzyme content, and are recommended in those cases where only small amounts of tissue are available as in biopsies.

Preparation and Characterization of Bovine Sublingual Mucin

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Upon acidification saliva and extracts from salivary glands form a ropy clump known as the mucin clot. Sublingual glands are smaller than submaxillary glands and have received less study.

In our investigation, the mucin clot was obtained by adjusting the pH of the neutral extracts of bovine sublingual glands to 3.5. Mucin was prepared from the clot by removing the substances which were insoluble in either acid or alkaline media.

The preliminary experiments showed that the purified mucin was nearly homogeneous on electrophoresis at pH 8.6. However, the presence of at least three components was indicated by ultracentrifugal analysis. The sublingual mucin contains sialic acid, but the content seems to be less than in submaxillary mucin. Purification and characterization of the mucin are still in progress.

The Change from Logarithmic to Logistic Growth

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If the rate of increase of a microbial population is proportional to the population and to the concentration of the "limiting nutrient," and the concentration of limiting nutrient is increased indefinitely, the generation time should decrease without limit. This does not occur in practice, as true logarithmic phases do occur in many cultures. A mechanism in the cell (perhaps the time necessary for the duplication of the genetic apparatus) must determine the minimum generation time (logarithmic generation time, T_g).

An expression for the "logistic generation time," T_g can be derived from the logistic growth equation. If it is assumed that growth is logarithmic as long as t_g equals T_g but becomes logistic after T_g becomes greater than t_g, theoretical growth curves can be computed which are very similar to those obtained for cultures in which the maximum population is directly proportional to concentration of nutrient.

The Limnology of a Small Artificial Impoundment in Alabama

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Limnological studies of a general nature have been conducted on many northern lakes and streams but few studies of this type have been attempted in southern waters. Those who have published results of such investigations include Bick, et al. (1953), Coker (1940), Eddy (1930), Hutchinson and Pickford (1932), and Moore (1950, 1952).

Small artificial impoundments and streams have received little attention in the southeast except for studies related to fish production and public health. For example, limnological data have been recorded for 20 years or more on many ponds at the Agricultural Experiment Station, Auburn, Alabama, by H. S. Swingle and staff but many of these records have not been assembled and published because of the applied nature of the work there. The present study is thus submitted as a contribution to the knowledge of southern limnology particularly as related to small artificial impoundments.

Descripition of the Lake

The Alabama College "lake" is a 17 acre body of water located in Shelby County, Alabama. This county lies in the geographic center of the state on the southern border of the Valley and Ridge Province of the Appalachian Highlands. The lake (Fig. 1) was formed by the impounding of a small stream in 1950 and was six years old when this study was initiated. The stream provides the primary source of water for the lake and maintains a steady flow. The average depth of the lake is about seven feet (2.1 meters) while the deepest area, the former creek channel, ranges from eight feet (2.4 m.) to fourteen feet (4.3 m.). The bottom consists of silt and clay, much of it being covered by filamentous algae, primarily **Spirogyra** and **Oscillatoria.** Thick mats of **Najas** are wide-spread during the spring and summer, other forms of aquatic vegetation being limited to scattered patches of cattail **(Typha latifolia)**, buttonbush **(Cephalanthus occidentalis)**, and willow **(Salix nigra)** around the border. Much of the lake is enclosed by steep, sparsely wooded hillsides which offer it some protection from winds.

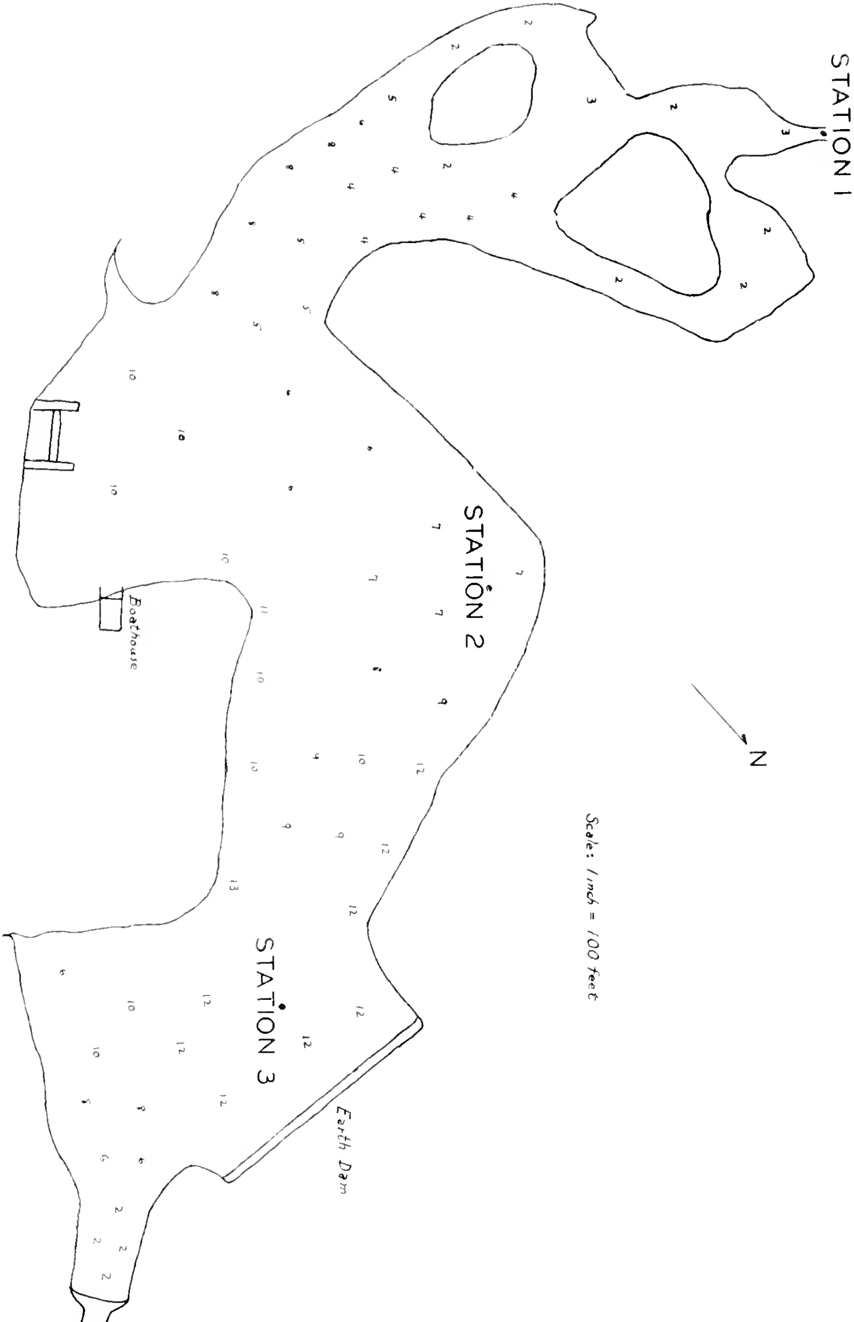

Fig. 1. Outline map of the Alabama College Lake showing collecting stations and depth soundings.

The lake serves as a recreation area for Alabama College and thus is used for boating and fishing. No swimming is permitted.

Methods

After mapping the pond and making soundings, three sampling stations were established: Station No. 1 at the creek entrance; Station No. 2 in the most "typical" portion of the lake as regards depth and bottom; and Station No. 3 in the deepest area. Each station was visited at intervals of ten days, other duties permitting, between the hours of 10 a.m. and 3 p.m.

At each station, the following chemical and physical determinations were made: dissolved oxygen, free carbon dioxide, phenolphthalein alkalinity, methyl orange alkalinity, pH, temperature, and Secchi disk readings for transparency. The chemical determinations were made according to Welch (1948) and the American Public Health Association (1955).

Hydrogen ion concentration was measured by means of a block comparator. Temperature readings were made on a Taylor maximum-minimum thermometer.

Net plankton samples were obtained by pumping 100 liters of water through a Wisconsin plankton net with a No. 20 silk mesh. At the start of the investigation, a two-liter Kemmerer sampler was used but due to the paucity of the plankters this sampler had to be abandoned in favor of the pump. In the laboratory each plankton sample was further concentrated to ten milliliters, one ml. of the concentrate placed on a one ml. counting cell, and the plankters enumerated in ten occular micrometer fields. This procedure was repeated on another one ml. sample of concentrate, making a total of twenty fields. The total plankton for the sample was then expressed in terms of numbers per liter. For the identification of organisms, Pennak (1953), Forest (1954), and Prescott (1954) were used.

At Station 2, the above sampling procedure was conducted at two depths, surface and near the bottom (6 feet, 1.8 m.). At Station 3 the procedure was followed at three depths; surface, midway to the bottom (7 feet, 2.1 m.) and near the bottom (14 feet, 4.3 m.). When the data from the three stations were organized and compared, it was noted that Station 2 and 3 were very similar in physical, chemical and biological features; therefore, the graphs concerning the third station have been omitted for the sake of brevity.

Thermal Characteristics

Stratification began at Station 3 in the middle of April and persisted until early in October, although at Station 2, only seven

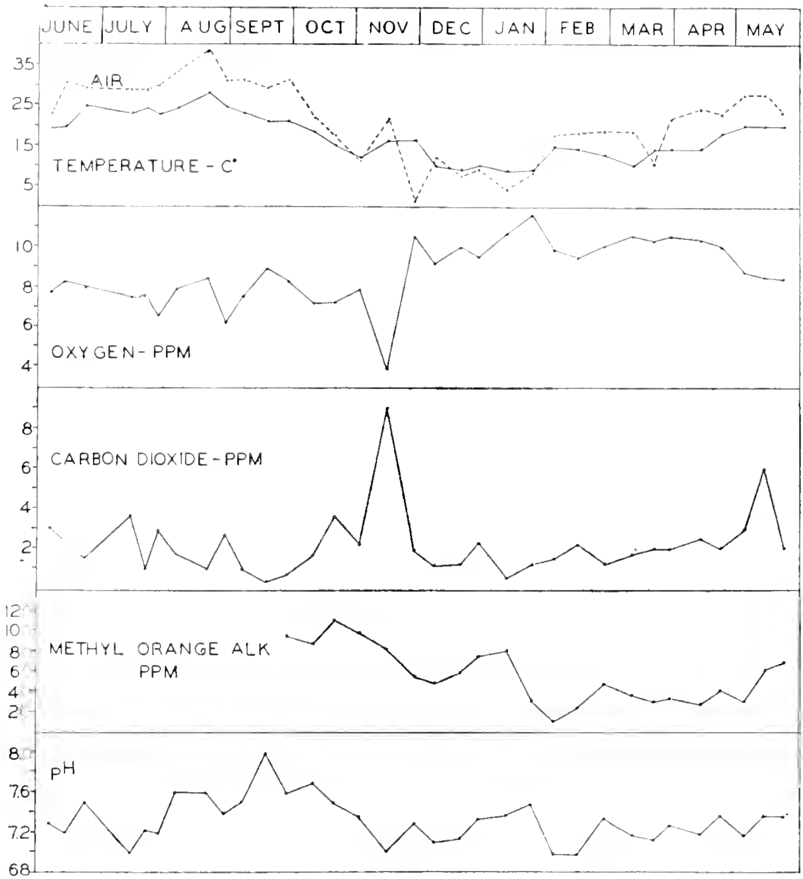

Fig. 2. Annual cycle of temperature, dissolved oxygen, carbon dioxide, methyl orange alkalinity and pH at Station One. All measurements, except air temperature, taken near the bottom (four feet).

feet (2.1 m.) in depth, stratification was recorded in late February and persisted despite frequent rains. Curves showing seasonal changes in temperature are recorded in Figs. 2 and 3.

The position of the thermocline shifted at Station 3 from a depth of two feet (0.6 m.) to eight feet (2.4 m.) and its thickness varied to about the same extent. The steep surrounding border and narrow configuration of the lake probably aided in the establishment of thermal layers.

The epilimnion averaged about two feet (0.6 m.) in thickness. The hypolimnion varied from two to six feet (0.6—1.8 m.) in thickness.

There was only one period of stratification, the lack of an ice cover in the winter preventing the winter stagnation period found

in northern lakes. The thermal conditions found here are similar in general to those found by Moore (1950, 1952) in Lake Providence and Lake Chicot in Louisiana.

The temperature of the inflowing water as recorded at Station 1 (Fig. 2) had little influence on the temperature of the lake water. This incoming water passes over a shallow area of considerable extent before reaching the main body of the lake (see map, Fig. 1).

Chemical Characteristics

Station Number One

This station was located at the creek inlet and was shallow; nevertheless, it was maintained as an essential sampling site since

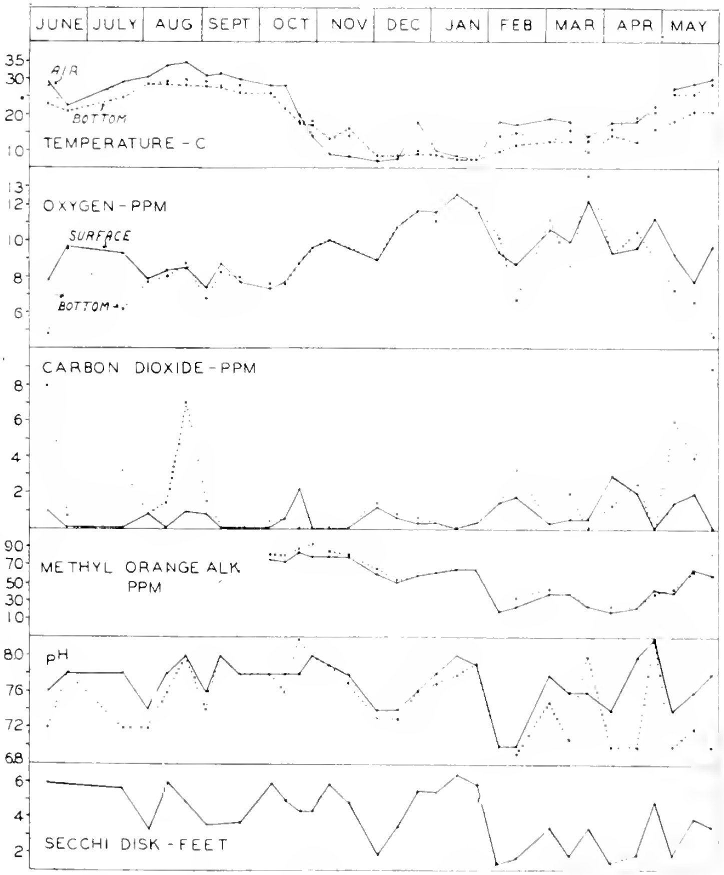

Fig. 3. Annual cycle of temperature, dissolved oxygen, carbon dioxide, methyl orange alkalinity, pH, and Secchi disk readings for transparency at Station Two. Solid lines: surface readings. Dotted lines: bottom readings.

it represented the water supply for the lake. The physical and chemical data gathered here are presented in Figure 2.

Dissolved oxygen varied from around 8 parts per million during the summer to about 10 ppm during the colder months. An exception was noted in mid-November when a low of 4 ppm (40 percent saturated) was recorded. A considerable rise in air temperature occurred on this date as well as a peak in free carbon dioxide (9 ppm).

Alkalinity was determined as phenolphthalein alkalinity for normal carbonate and methyl orange alkalinity for normal carbonate and bicarbonate. No normal carbonate was recorded but the bicarbonate content was high, varying from over 100 ppm in October to less than 20 ppm in early February. This reduction in bicarbonate was possibly due to the greater dilution of water during the winter months of increased rainfall. The same condition was recorded at the other collecting stations.

Hydrogen ion concentration varied from a pH of 7.0 to 8.0 and averaged about 7.4. A pH below 7.0 was never recorded, a reflection of the small quantities of free carbon dioxide present.

There was a reciprocal relation between dissolved oxygen and free carbon dioxide (Fig. 2).

Station Number Two

This station, located in an elbow of the lake, was intended to more or less typify the average conditions found in the impoundment. The depth was seven feet (2.1 m.) during most of the sampling period. Thermal conditions resembled those discussed previously for Station 3.

Figure 3 shows in graphic form the chemical and physical conditions prevailing at the station during a one year period. The amount of dissolved oxygen at the surface and bottom was approximately the same except during the summer months, and even then the differences were not great. During June a low of 4.7 ppm (45 percent saturation) was recorded in the bottom waters, and in March an overall high of 13.5 ppm (123 percent saturation).

The amount of free carbon dioxide was small, even with the occasional peaks of 8 ppm or less found near the bottom. No normal carbonate was recorded and the bicarbonate content averaged around 50 ppm. Hydrogen ion concentration remained on the alkaline side, varying from a pH of 7.0 to 8.2 with a considerable fluctuation during the colder months. Secchi disk readings varied from 1.5 to 6.5 feet (0.45 to 1.98 m.), the lower readings being recorded after periods of rainfall when the water was clouded with silt and or-

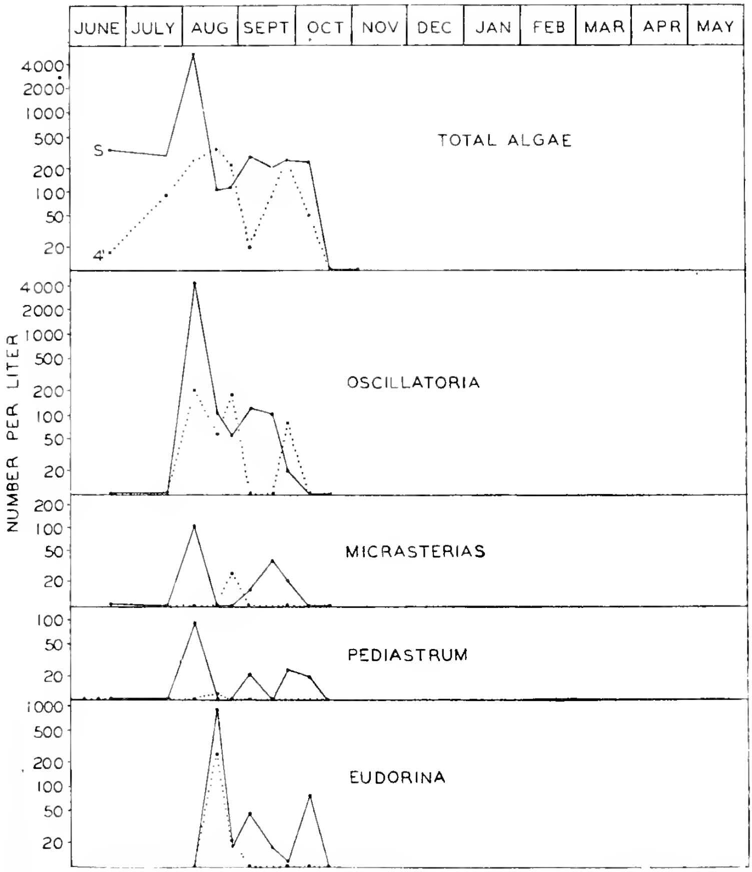

Fig. 4. Annual cycle of phytoplankton at Station One, recorded on a logarithmic scale.

ganic matter. At this time the pH dropped and free carbon dioxide tended to increase (Fig. 3).

Net Plankton Collection at Station One

In general the variety of net plankter collected here was small and seldom was there a large concentration of individuals. No forms were recorded after October.

The phytoplankton genera of regular occurrence were: **Eudorina, Pediastrum, Micrasterias**, and filaments of **Oscillatoria**. These are enumerated in Fig. 4 as numbers per liter on a logarithmic scale. **Oscillatoria** filaments constituted the most common form of algae.

The zooplankton included the following forms: PROTOZOA, **Difflugia, Gonyaulax**; ROTATORIA, **Conochiloides, Filinia, Pedalia, Polyarthra, Brachionus, Keratella**; CLADOCERA, **Ceriodaphnia, Diaphanosoma, Bosmina, Alona**; COPEPODA, **Cyclops, Ortha-**

cyclops, Diaptomus, and **nauplii.** The forms of regular occurrence are noted on Fig. 5 on a logarithmic scale.

Rotifers were by far the most numerous of the zooplankters, in particular the Genus **Keratella.** Cladocerans occasionally occurred in considerable numbers.

Net Plankton Collected At Station Two

Net phytoplankters occurred in such small numbers that they are not included in the plankton graphs (Figs. 6 and 7) for this station. Small numbers of the following algae were taken consistently: **Eudorina, Pediastrum, Micrasterias, Phacus,** and **Closterium.**

The zooplankton included the following genera: PROTOZOA, **Difflugia** and **Gonyaulax;** ROTATORIA, **Conochilus, Conochiloides, Filinia, Pedalia, Collotheca, Polyarthra, Synthaeta, Brachionus,**

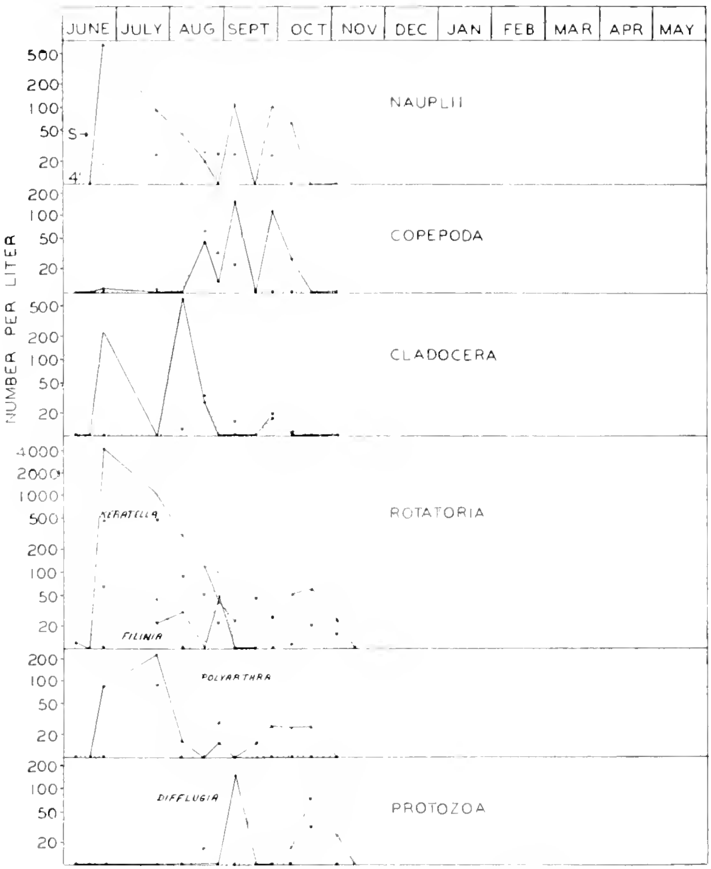

Fig. 5. Annual cycle of zooplankton at Station One, recorded on a logarithmic scale. Collections made at surface (solid line) and bottom (dotted line).

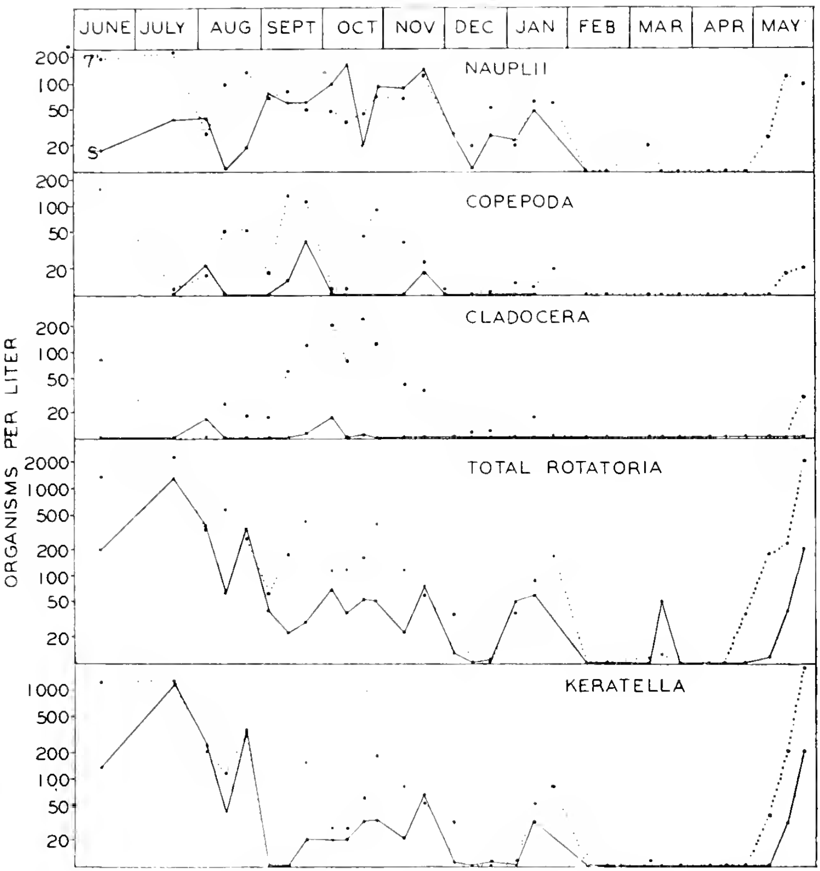

Fig. 6. Annual cycle of zooplankton at Station Two, recorded on a logarithmic scale. Collections made at surface (solid line) and bottom (dotted line).

Keratella, **Lecane**; CLADOCERA, **Ceriodaphnia**, **Diaphanosoma**, **Bosmina**, **Alona**, and **Daphnia**; COPEPODA, **Cyclops**, **Orthocyclops**, and **Diaptomus**.

As observed at Station One, rotifers were the most numerous zooplankters with **Keratella** dominating. All of the rotifers, except **Keratella**, were present for a limited time, usually two or three months. **Synchaeta** appeared in the collections after the other rotifers had become scarce (Fig. 7).

Except for the nauplii, all zooplankters were more numerous near the bottom than at the surface.

Orthocyclops was the most frequently collected copepod with **Diaptomus** and **Cyclops** next in order, **Ceriodaphnia** and **Daphnia** were the major members, with the former being by far the more

numerous. **Diaphanosoma** and **Bosmina** were regularly collected in small numbers, and **Alona** observed sporadically.

In comparing the fluctuation in numbers of zooplankters with the physical and chemical data, a few generalities seem evident. All forms declined in numbers as the water became colder, some forms disappearing entirely. When several days of rainfall caused a decrease in the transparency of the water, the abundance of copepod nauplii and of **Keratella** declined, but the other plankters seemed not to be affected.

The months of February, March, and April represented a period of extreme scarcity of net plankton, possibly due to the greater flushing action of relatively heavy rainfall generally occurring at that season.

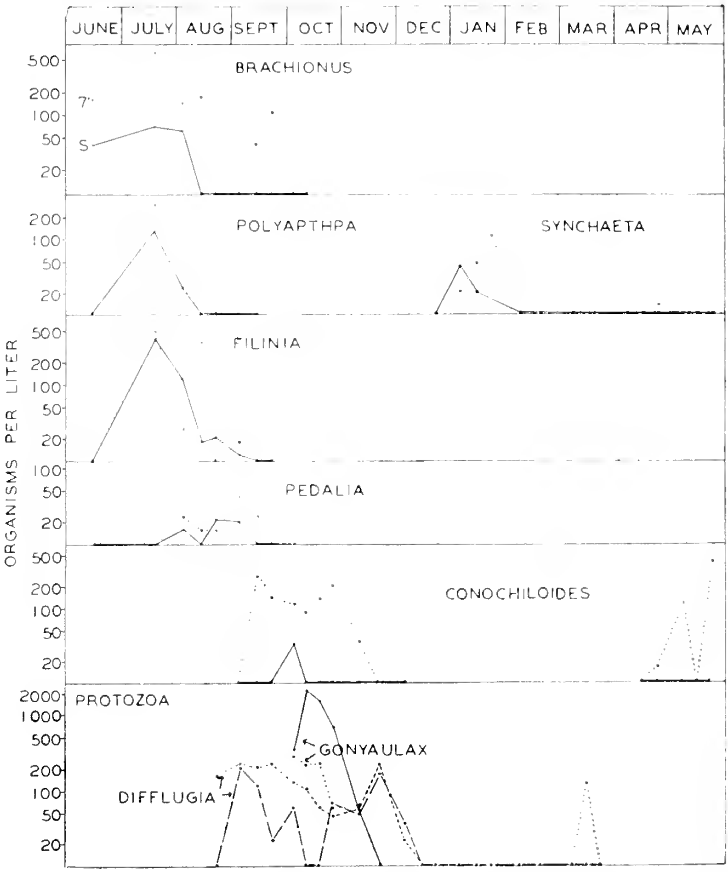

Fig. 7. Annual cycle of zooplankton at Station Two, recorded on a logarithmic scale. Collections made at surface (solid line) and bottom (dotted line).

As explained previously, Station Three was very similar to Station Two although the depth was twice as great. The same plankters were collected at both stations and in about the same proportion. Phytoplankters were scarce at both stations.

Discussion

A comparison of the three collecting sites indicates a great amount of similarity in the physical and chemical conditions existing among them. Free carbon dioxide was nowhere abundant and the pH consequently remained between 7.0 and 8.0. The only extreme variation in the amount of dissolved oxygen occurred in the depths of Station Three during the summer.

In the summer, stratification occurred throughout the lake. Rainfall considerably decreased the transparency of the water although this in turn seemed to have little influence on the fluctuations in numbers of most of the plankters.

Phytoplankton were not abundant at any of the stations and were found most frequently at Station One in the creek inlet. This would seem to indicate that the inflowing water was richer in plant nutrients than the remainder of the lake. The creek borders several cultivated fields from which commercial fertilizer must wash during rains. In addition, rooted aquatic plants in the main body of the lake may deprive the algae of nutrients there.

Rotifers were the only zooplankters which ever became really numerous. One copepod, **Orthocyclops,** and two cladocerans,**Ceriodaphnia** and **Daphnia,** made up the bulk of microcrustacea. Considering the total net plankton picture present during the annual cycle, it appears that the Alabama College lake is rather low in zooplankters and extremely poor in phytoplankton. The factor of a continuous flow of water into the lake as well as a constant drainage from it (by means of a spillway) is probably a dominant influence affecting both the chemistry of the water and the plankton production. Subsequent to heavy rainfall, nutrient materials entering the impoundment would not remain there for long. Thus the sharp drop in plankton production during the winter months corresponds approximately to the onset of increased precipitation characteristic at that season of the year.

Summary

1. The Alabama College Lake, Shelby County, Alabama, is a 17 acre body of water averaging about seven feet in depth. The lake, impounded in 1950, has a narrow, irregular configuration and is partly surrounded by hillsides.

2. Three sampling stations were established and visited at ten day intervals for the period of one year.

3. One period of stratification existed from April to October, the depth of the thermocline shifting from two to eight feet.

4. There was an essential uniformity in the chemical and physical conditions at the three collecting sites. Free carbon dioxide was low and the pH remained on the alkaline side. Dissolved oxygen remained at a fairly high level during the year and an oxygen deficiency was seldom found except on sporadic occasions in the deepest parts of the lake.

5. Net phytoplankters were scarce throughout most of the lake, the creek inlet being the only place where they were present in considerable numbers and then only for a limited time.

6. Of the zooplankters, only the rotifers and particularly **Keratella,** reached a peak of one thousand or more per liter. All plankters became scarce from February to May.

7. Vertical distribution of plankters indicated a slightly greater abundance near the bottom than at the surface.

8. The Alabama College Lake does not support a very large variety or abundance of net plankton. The continuous flow of water through the impoundment was considered a major factor influencing the poor plankton production.

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Social Science Section

Religion in the U. S. S. R.

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In recent years a significant change has occurred in the governmental policy of the U.S.S.R. toward religion. Beyond any doubt, party leaders and ideologists still repeat the "eternal truth" of the Marxian formula that "religion is the opiate of the people." Nonetheless, since the beginning of World War II, organized religion, and in particular, the Russian Orthodox Church, has been given some renewed prestige, and, above all, regardless of continuous attacks, some kind of security for the time being. Religion may now be practiced more extensively than before the war, priests may be trained, and religious works may be printed on the very presses that were once used for the dissemination of anti-religious propaganda. Even so, the basic contradiction still exists in the official fight against religious tenets and the official permission to carry on with religious practices.

Historically, the treatment of religion in Russia has not been based on the principles of freedom of religion as these typically appear in the Western countries. The pre-revolutionary period of the Czarist regime was fraught with inequalities inflicted on the many religious groups in the country. During the Czarist era the great majority of the people of Russia were followers of the Russian Orthodox Church. Other denominations could be found throughout the realm, ranging from Roman-Catholicism, some Protestants (mainly Lutheran) and a large Jewish group, to a considerable number of Moslems, as well as adherents to some of the Far Eastern religions. Altogether there were more than forty sects and denominations. While the very presence of these many religious expressions might have been considered by outsiders as evidence of freedom of religion, in reality, only the Russian Orthodox Church enjoyed a secure position and preferred treatment.

As the worldly leaders of the Church, the Czars, and in particular Nicholas II, had used the Church in an endeavor to "Russify" the country and had found it a very docile instrument. The Church, satisfied with its privileged position, had opposed any freedom for other creeds, and had given all of its support to the real intentions

of the government to convert people to the "only" Church. So the religion of the majority of the population became a governmental device for better political, cultural, and ideological control.

After the revolution of 1917, the new rulers were hostile to religion for many reasons. To begin with, the Marxian teachings violently opposed religion as being contrary to materialism and to the scientific methods of explaining man's existence and struggle. "Religious superstition" as an integral part of "the old bourgeois ideology" had to be eradicated in order to make a place for the hopes of the new Communist who would find his paradise in the "classless society" as a result of his new education and his undivided loyalty to the new cause. Lenin, and later Stalin, saw religion as a threat to the complete devotion that seemed to be the necessary and basic attitude in the fight for communism. Adherence to any religion created divided interests and sc interfered with the plans of the new leaders. The very existence of a totalitarian regime is threatened unless it can embrace the whole of its subjects' lives.

The revolutionary fight against religion was started immediately not only by undermining the material position of the Church, but also by specific educational campaigns of anti-religious propaganda. The functions of the clergy were severely limited and many of its members were arrested, particularly those who had given moral support to the White Russian armies in their fight against the Red army and communism. Church property was confiscated, and the clergy was disfranchised in the early constitutions of 1918 and 1924. The official stand of the new regime might be best described by one of Lenin's statements on this issue. In a speech to a meeting in Presnya Borough at Moscow, on July 26, 1918, he took the floor in order to acquaint his listeners with the substance of the new Soviet constitution. He stressed, according to reports on the meeting, the newly gained rights of the toiling masses. Then he turned to religion, which he described as now being

> a private affair. Let everyone believe what he pleases or believe in nothing. The Soviet Republic united the working peoples of all nations and champions the interests of all the working people, irrespective of their national affiliation. The Soviet Republic acknowledges no religious differences. It is outside all religions and has separated religion from the Soviet state.*

* This particular statement comes from new materials of the Party Central Committee's Marxism-Leninism Institute *New V. I. Lenin Documents* which were published in the *Kommunist,* No. 7, April 1957, pp. 1-8. The English translations can be found in the *Current Digest of the Soviet Press* of May 29, 1957 (Vol. IX, No. 16, p. 3.)

Yet it was also Lenin who, following Marx, in Socialism and Religion (1906) would say

> Religion is the opium of the people. Religion is the kind of spiritual vodka in which the slaves of capital drown their human shape and their claims to any decent human life.

The ideological war of the communists against religion was largely carried out by the energetic League of Militant Atheists, an organization which was founded in 1925. Throughout the following years militant atheism was clearly the acceptable position which was finally made official by the (Stalin) Constitution of 1936. Article 124 provided that "freedom of religious worship and freedom of anti-religious propaganda is recognized for all citizens." Religious worship was basically a negative right, signifying that voluntarily formed religious societies could have places of worship and conduct religious services, but it did not include the possibility of proselytizing or any social and humanitarian functions. On the other hand, anti-religious propaganda was positive, invested with the right of attacking religion through public addresses, exhibitions, and the press, since religious inclinations were regarded as a "delusion which poisons the heart" of the people, and since "religious superstitions like other survivals of capitalism hinder in our Soviet country progress towards communism."

Numerous anti-religious periodicals, articles, books and pamphlets were published, and the league set up courses in atheism. In addition, in 1929, a law was issued which forbade religious teaching, "exercising any charity, or any social, intellectual or cultural activities." Only books "necessary for the purpose of the cult may be kept in the buildings and premises used for worship." Other decrees prohibited the teaching of any form of religious belief to persons under 18 years of age as well as the private instruction of children in groups comprising more than three. The Statute on Secondary Schools of 1934 for the Russian S.F.S.R. asked specifically for the "anti-religious upbringing of the students and (that it) shall build instruction and educational work upon the basis of an active fight against religion and its influence upon the student and adult population." Members of the Party and of the Communist Youth League, the Komsomol, were expected to be leaders in the fight against religion. The students were to have an intensive education in science following Stalin's slogan: "Science can conquer all fortresses; all religion is contradictory to science."

Yet, impressive changes came during the years of World War II which accorded recognition, if not prestige, to the Church. One reason for this was the official discovery that many people in the

country, particularly the peasants, had remained religious. In fact, as early as 1937, it had been acknowledged in official circles that a third of the adult urban population and two-thirds of the rural population were, at least to some degree, religious. During the war the changes in the status of the Church were granted primarily because the Church had rallied to the cause of the Soviet Union, but also because of the alleged interest of President Roosevelt in the problem. The government made significant concessions: the dissolution of the League of Militant Atheists, the prohibition of its publications, and the turning over of its facilities and presses to the Russian Orthodox Church. A Church Council was permitted to convene in 1943 and a Patriarch, the highest dignitary of the Church, was elected. This was followed by the institution, in 1944, of a Ministry of Orthodox Church Affairs and one of Religious Cult Affairs for other sects and denominations.

Nevertheless, throughout the years following World War II, one could observe an outspoken return to anti-religious attitudes in the government and the party. For some time no official comments were made against such "regression" so that one could only conclude that an unavoidable return to orthodox atheist propaganda had taken place. This appeared to be true particularly for the period following Stalin's death. It was then that religion was accused of being intrinsically alien to the ideology of Soviet man, and its practices were attacked as manifestations of strange superstitions and prejudice. Religious holidays, celebrated at the busiest periods of agricultural work, were blamed for the "many cases of absenteeism, drunkenness, and hooliganism." It was particularly resented that "even young people and a few Communists sometimes take part in these celebrations."

But something must have gone wrong, or the return must have been too impetuous, for in a decree of November 10, 1954, the Central Committee of the Communist Party commented "on errors in conducting scientific-atheist propaganda among the public." At that time the official organ of the Central Committee pointed out that

> . . . instead of developing systematic and painstaking work to spread materialist knowledge of natural science and waging an ideological struggle against religion as an ideology, some central and local papers, as well as speeches by some lecturers, offensively attack clergy and believers and publish the names of churchgoers. In some cases the press and lecturers by propagandists depict some ministers and believers without reason, as people who do not merit political trust. In many districts local organizations and individuals permit themselves to engage in governmental interference with the activity of religious

associations and groups and indulge in rudeness toward the clergy.

Mistakes of this kind in anti-religious propaganda—offensive attacks against religious believers and the clergy—are contrary to the U.S.S.R. Constitution, which allows the Soviet people freedom of conscience. Any administrative measures or rudeness to believers and the clergy are incompatible with the Party line on scientific-atheist propaganda and contrary to the whole spirit of Marxism-Leninism, which demands that work to overcome religious superstition be conducted by ideological means, not by administrative measures. The program of the Communist Party demands that in conducting atheist propaganda "offending the feelings of believers, which only leads to strengthening their religious fanaticism" should be carefully avoided.

However, these instructions by the Party are not always heeded on the spot; they are sometimes grossly violated. As a result of lack of control by some Party bodies, press and oral propaganda sometimes indulge in an incorrect attitude toward believers and clergy.

Although the Central Committee regretted the anti-religious fight that offended the "feelings of believers," it was clear that the philosophy of Communism in regard to religion had not changed. The statement of the Central Committee of November 1954, signed by N. Khrushchev, while deploring such insulting attacks, spelled out again the doom of religion:

Whereas, in relation to the state, religion is a private matter and therefore the church is separated from the state, the Communist Party, which bases itself on the only correct, scientific world outlook—Marxism-Leninism—and its theoretical foundation, dialectical materialism, cannot adopt an apathetic, neutral attitude toward religion, an ideology which has nothing in common with science.

. . . The fundamental opposition of science and religion is obvious. Whereas science relies on facts, scientific experiment and conclusions strictly checked and confirmed by life, any religion bases itself only on Biblical and other traditions, on fantastic fabrications. Modern scientific discoveries in the natural and social sciences convincingly refute religious dogmas. Science cannot be reconciled with fabricated religious concepts about the life of nature and man, hence it is incompatible with religion. Science helps mankind to delve more and more deeply into the objective laws of the development of nature and society, helps to place the forces of nature at the service of man; science helps to increase man's awareness and raise his culture; but religion clouds man's consciouness, condemning him to passivity in the face of the forces of nature and fettering his creative activities and initiative.

Taking all this into account, the Party considers profound, systematic scientific-atheist propaganda essential, without, however, permitting the religious feelings of believers and also of clergymen to be offended.

In other recent articles the Soviet ideologists have pointed out that scientific communism demands from man that he devote all his attention to the cares of creating a happy life on earth, while religion "directs the believer's gaze to heaven, to a life beyond it."

The materialistic approach of communism rejects the need for supernatural forces; in fact Lenin contended that the struggle against religion is the ABC of all materialism and consequently of Marxism. The following statement by Lenin has not been forgotten: "Any religious idea, any idea of a 'good God,' any coquetry even with a 'good God' is an abominably nasty thing which is met especially tolerantly (often benevolently) by the 'democratic bourgeoisie' and is just for that reason the most dangerous abomination, most odious infection."

Obviously, it would be completely erroneous to come to the conclusion that the decree of November 1954 gave a position of real security to the Church. It appears evident from all official statements that the leaders, certainly the overwhelming majority of the party spokemen, have not changed their attitude toward religious matters. They still profess the need for scientific, atheist education, but they have added a new emphasis by asking for patience and for a more skillfully organized propaganda against religion. They publicly refer to the advice given by Lenin in 1918:

> Great care is called for in combating religious belief; great harm is done by those who offend religious feelings in this struggle. One should wage the struggle by means of propaganda and education. By making the struggle a sharp one, we may anger the masses; such a struggle reinforces the division of the masses along religious lines, and our strength lies in unity.

While Lenin is cited as the preacher of patience, he is also used in the same statement as the gospel for spreading atheism by referring to his programmatic article, "On the Significance of Militant Materialism."

There has been issuance and reissuance of the works of French writers of the 18th century such as Voltaire, Rousseau, Diderot, Holbach, and others. This is true also of writers of later and earlier periods and the latter ones are called "atheists of ancient times (Democritus, Epicurus, Lucretius, Lucian)." While consideration and tolerance for religion is avowed, the publication of atheist literature is regarded as "an unquestionable contribution to the struggle for finally overcoming religious survivals and superstitions in our country." In fact, one can find articles in recent Soviet newspapers, in which the definite improvement in anti-religious propaganda based on the natural sciences is subject of laudable comment.

At the time of the action of the Central Committee most Western observers did not interpret the decree as representing any basic change by the Soviet leaders towards the Church. In fact, some observers saw it only as a way of telling the party faithful—editors,

agitators, lecturers and the cell leaders—to be more clever and self-restrained, to adjust themselves to the official line of soft persuasion. However, it was also felt that there was a religious revival in the Soviet Union, expressing itself in an increase in church attendance and in resentment of some attacks that were in such bad taste that probably even the Communist leaders might have felt embarrassed. There was particular reference to cartoons in the Russian magazine Krokodil that lampooned priests and citizens at prayer.

The fight against religion has always been stressed in the educational program of the Young Communist League, the Komsomol. Since it probably has a membership of about 18,000,000, the Komsomol forms the pool for the future membership of the party. It is also the training ground for the U.S.S.R.'s leaders of tomorrow.

The national congress of the organization in 1954 (first meeting in five years) was told by its national secretary that it was necessary to acknowledge that "anti-religious propaganda in the Komsomol has been seriously weakened and in some places it has entirely ended." He also pointed out that some Komsomol leaders were inclined to underestimate the harmful influence of the church on young people and children, and that as a result considerable numbers of Soviet youths were falling under the spell of "religious ideology." It was proposed that such attitudes toward church activity among youngsters must be ended and atheistic propaganda carried out so that Communist youth would know the whole "truth" about religion. The organization still directs attention to Lenin's remarks on the occasion of the Third All-Russian Komsomol Congress:

> We repudiate all morality derived from non-human and non-class concepts. We say that it is a deception, a fraud, a befogging of the minds of the workers and peasants in the interests of the landlords and capitalists.

The official leadership probably feels that it has found the proper place for religion and its impact on society by aligning it as follows in the Statutes of the Komsomol:

> To be honest, truthful, to restrain his comrades from wrongful acts, to respect the laws of Socialist communal life, to fight against drunkeness, hooliganism, the remnants of religious superstition, and uncomradely behavior towards women . . .

These official pronouncements disclose an uncompromising attitude, but at the same time they also reveal an anxiety that Soviet youth has not been won for the cause of progressive science in contradiction to religion. Articles appearing in Pravda and Izvestia have admitted that: "There are still cases where Komsomol members,

under the influence of a backward state of mind, go to church and in this respect certain Komsomol organizations show a lack of understanding their duty."

One cannot help but wonder whether the co-existence of these obviously contradictory attitudes (fight against religion; toleration of religious practices) does not indicate hypocrisy and lip service to one of the two, if not to both causes. Do the people want, after all, the survival of religion? Or have they now, after 40 years of the Soviet regime, become disinterested and are waiting for the gradual withering away of religious feelings? There is something bewildering about these official pronouncements favoring greater tolerance of the religious feelings of the "honest toilers" and the clergy and, in the same article, quoting Lenin who called religion a "morbid fantasy" based on "fantastic fabrications."

Some authors have suggested that precarious recognition by the Soviet leadership committed the Church to a "policy of unconditional fealty and blind support." (See Vladimir Gsovski, *Church and State Behind the Iron Curtain,* New York, 1955, p.xxvi). This interpretation might be derived from the fact that the Russian Orthodox Chuch joined (or had to join) the World Congress of Supporters of Peace, the Stockholm Peace Petition, and even filed with the United Nations a protest against its actions in Korea, accusing the United States in particular of aggression. Does this mean a preparedness of Church leaders to commit, if necessary, religious suicide? Or could it be a very smart maneuver of the Soviet officials to create a policy similar to the "Russification" program of the Czars which had made the Russian Orthodox Church a governmental instrument for political and cultural controls? There is, of course, a fundamental difference between Communists and the Czars. While the Communist speak against, and fight religion, it was always apparent that the Czars were firm believers and deeply involved in religion. Since they were religious they wanted devout subjects, but preferably of *one* kind and of *one* religious expression, to be found only in the Russian territory. It may be safely assumed that the Communists are opposed to religion as a philosophical and ethical belief; they probably would prefer to have their country free of any religious expression. But so long as they recognize the existence of religious devotion and fervor they also realize that it is practical to permit such attitudes if they can be kept under firm and safe control. There is no doubt that a religious expression coinciding with the extent of the territory of the U.S.S.R could be easily ruled, so that any organized

religious group, without international affiliation and support and therefore possibly divided loyalty, would be permissible.

During World War II all of the religious organizations in the Soviet Union rallied to the cause of the country and gave their whole-hearted assistance to the government. Soviet leaders and the press lauded the churches for their patriotic stand; among others, the Baptists and other Protestant groups were praised for their wartime support and actions. But it was the war which gave Soviet leaders a chance for total control. Once the war was over and the possibility for international religious affiliations, at least in theory, returned, it became obvious that the suspicion of connections with church groups abroad could, and often did, lead to persecution and the accusation of treason. While religion as a philosophical argument had always been under attack, specific acusations were made only against those groups where the possibility of divided and foreign loyalty has seemed probable. Under these circumstances it is not surprising that Roman Catholicism and different Protestant denominations, such as the Baptists, Jehovah's Witnesses, and the Seventh-Day Adventists, have been subjected to accusations and restraints.

Islam has been continuously attacked, although the Soviet government has permitted some Moslems in the U.S.S.R. to join in pilgrimages to the holy places of Mohammedanism. But Soviet newspapers have, by mentioning the names of countries such as Turkey, Iran, Pakistan, Indonesia, and Afghanistan, maligned Islam as a state religion, and as a helpful instrument in the hands of the "ruling and exploiting classes of these countries." The Moslem League in Pakistan has been accused of being "an agent of American imperialism," supporting the formation of a military bloc of the countries of the Near and Middle East under the aegis of the United States. In their endeavor to prove that Islam is in the service of modern imperialism, Soviet writers have declared that:

> The use made by the imperialists of pan-Islamism—a religious political teaching issuing from the idea, related to cosmopolitanism, of uniting all Moslems and setting up a kind of "Islamistan"—has increased especially in recent years. During the second world war Pan-Islamism was made wide use of by Hitler and Mussolini for their rapacious aims. Now the American imperialists and their servitors wish to make use of the appeal for carrying out a pan-Islamic program as a screen for the aggressive bloc being set up by the U.S.A. (*Current Digest of the Soviet Press*, Vol. VI, No. 40, November 17, 1954.)

The Moslem ritual has been described as hindering "the de-

velopment of the national and class consciousness of workers and peasants," and the Koran has been depicted as "protecting the exploiters' society."

A dynamic fight has been conducted against the Jews. Antisemitism, while officially scorned, has become a part of Soviet life and has been particularly noticeable in the accusations made against Jewish doctors. It is, however, Zionism and the founding of the State of Israel (ironically enough, only possible because of Soviet assent to this event) that have caused a postwar campaign against "rootless cosmopolitans." As Merle Fainsod has pointed out in *How Russia is Ruled*: "While official policy remains ostensibly opposed to anti-semitism, anti-semitic cartoons have appeared in the Soviet press, and evidence of discrimination against Jews in public life have accumulated in the postwar years."

Any organized religious manifestation, which might find support abroad, will be viewed with suspicion by the Soviet leaders. On the other hand, any religious expression, rooted in the people of the country without any outside contacts, will be tolerated, since it will only contribute to an increasing popularity of a regime that has managed to bring under control all of the important human actions and emotions so necessary for the average human being. One can indeed take it for granted that, in return for freedom of worship, church leaders are willing to accept political orders from the Soviet leaders. Thus many people are attending church services regularly, and reports from many sources clearly reveal that the churches are crowded. A Quaker mission, visiting the U.S.S.R. in 1955, found 54 churches in Moscow open and had a chance to see a service which was attended by a congregation of 5,000. Similar reports were given by a delegation of the National Council of the Churches of Christ on the occasion of a visit in 1956. Others have stated that more young people were going to church and reference has even been made to the fact that party personnel have been seen worshiping in public. Eleanor Roosevelt, on the occasion of her visit in October 1957, attended services in several churches, and, in fact, observed great numbers of young people at a service in the Baptist Church in the outskirts of Moscow.

No doubt, with the help of a new clergy of the Orthodox Church, trained under state control, submissive to the demands of a stern government, and considered as politically loyal, the Soviet government can afford to fight religion as an ideological phenomenon, and yet tolerate its practice, if practice means, after all, nothing but the individual expression of well-supervised persons who will

not dare to betray or overthrow the government of the Communists. As to control, there is no difference between Lenin's thoughts and those of Krushchev whose revolutionary and intellectual idol in all matters has been Lenin. Under all these circumstances it seems to be safe to assume that the right to practice religion in the U.S.S.R. had to be bought at a high price and with a continuing uncertainty as to the intentions of the Soviet leaders.

The Manufacturing Interests of Alabama Planters, 1810-1830

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A variety of circumstances encouraged the rise of manufacturing industry in early Alabama, and consequently ten years before the establishment of a state government, at least one cotton factory had sprung up in the Tennessee Valley. In 1809 conditions nationally and locally were conducive to the beginning of manufactures: the Jeffersonian Embargo had interrupted the natural trade relations of planters with England; and the lack of transportation out of the isolated valley made it difficult for planters to export their cotton and to secure manufactured goods. Charles Cabiness, an early settler of Madison County, established in 1809 the first cotton spinning mill in what was to be Alabama.([1])

Evidently the need for yarn led to the establishment of similar primitive cotton mills throughout the Mississippi Territory, for the United States Marshall, census takers in 1810, reported that twenty-one such establishments were operating in that area.([2]) These experimental beginnings were made in every Southern state within the period from 1805 to 1816. Unfortunately the dumping, at cut-rate prices, of British textiles on the American market after 1815 put many of these mills out of business. The isolation of the Tennessee Valley, however, protected the Cabiness Factory and enabled it to continue its operations, and as late as 1818 its coarse yarns were advertised for sale in local markets.([3])

Although Alabama planters were largely interested in growing cotton, they were made aware of the advantages that cotton manufacture would bring them. The editor of the *Alabama Republican* urged planters to shake off their dependence upon Kentucky hemp

growers and manufacturers, and to manufacture and use bagging made of cotton for preparing their bales for market. He suggested editorially that bagging could be woven domestically by slaves trained on the plantations, or if this proved unfeasible, he questioned, "would it not be an object worthy (of) the attention of an association of gentlemen to establish a manufactory of so indispensible an article?" The advantages of domestic manufactures were twofold: they could supply at home this indispensible article and use their inferior cotton in its manufacture.(4) However, at the primitive spinning mill of Charles Cabiness no effort was made to weave cloth.

As the peak of the cotton growing profits passed with the end of the long European wars, and as the price of hemp bagging rose rapidly, due to tariff protection after 1824, other individuals in the Tennessee Valley followed the pioneer efforts of Cabiness and Company. William Haughton established a wool carding factory in a building which had been used by Horatio Jones for his first cotton factory.(5) Meanwhile Jones built a second and more extensive factory to spin and weave cotton, and produced yarns and coarse shirtings on water driven spindles and looms.(6) A third cotton factory was begun by Joseph Harding the following year on the mountain fork of the Flint River. Harding's factory was smaller and produced only spun yarns, which he offered to the public for cash or in exchange for seed cotton "on accommoting terms."(7) At the other end of the valley near Florence, Daniel Rider and William McRobb established a spinning mill about 1820, which they later sold to Samuel Bolton.(8) Thus, along the banks of the small streams feeding into the Tennessee River, small factories were rising as a result of necessity.

By 1826 planters began to take an active interest in promoting cotton factories to produce cotton bagging and Negro clothing. A group of leading planters in Madison County, lead by Thomas Bibb and LeRoy Pope, advertised their willingness to encourage any entrepreneur by pledging to buy these two items from any person willing to risk the capital to establish a cotton manufactory. These planters described the type of goods they needed and expressed a desire to secure them at a "fair price." They were ready either to sell the manufacturer the necessary cotton, or to furnish the raw material "and pay . . . a liberal price for the skill and labor of manufacturing it." They expressed a willingness to sign a contract for the required goods, and stated their belief that all the planters of the valley would patronize such a factory, and would annually purchase from it the 250,000 yards of cloth currently pur-

chased from outside sources. They further assured such manufacturers that there was plenty of good water power in the Huntsville area. Twelve planters signed the advertisement, pledging themselves to buy annually 18,200 yards of cotton bagging and 7,600 yards of Negro cloth.(9)

William Figures, editor of the *Southern Advocate,* called special editorial attention to this proposition of these progressive planters. He urged some caiptalist to take advantage of this opportunity, in a region where there was no competition to reduce profits, and where the planters were willing to pay a price equal to that paid for imported fabric. "Coarse fabrics suitable for these objects, are very heavy article of transportation, and the isolated situation of this valley, remote from navigation, renders it highly eligible for such manufacturing establishments." He pointed out that food products were abundant and cheap, labor available, water power unlimited, and climate pleasant, which all combined made the region eminently suitable for manufacturing. The planters of the valley, he said, would patronize a local mill in order to keep money in local circulation, and also to save the heavy charges at Liverpool where four per cent of the weight of the bales was subtracted to make up the weight of the hempen baling, an item estimated to cost the planters $80,000 for the cotton shipped from the Tennessee Valley. In conclusion he said "we hope this subject will attract the attention of enterprising manufacturers in the Southern States."(10) The following year the same editor was again urging the local manufacture of these items, pointing out that such an enterprise would help diversify the agricultural activities of the region by creating a demand for food for factory workers.(11) Phillip Woodson, editor of the *Democrat,* pointed out that the establishment of factories would increase the domestic consumption of cotton in making bagging, blankets, rope and osnaburgs, and thus help bring the growth and use of cotton into a closer balance.(12)

The *Southern Advocate* reprinted promotional materials from other Southern newspapers discussing the activities of planters in sister states. A planter near Natchez, Mississippi urged his fellow planters to take an active part in the establishment of factories. He wrote that the cotton crops of Louisiana and Mississippi would consume five thousand bales of cotton for bagging and rope. This would, he said, solve partially the problem of overproduction of the staple and enable the planter to fabricate his own supply of materials. In conclusion, he said, "let us unite in a determination to *manufacture our bagging out of our inferior cotton.*"(13)

The planters of Adams County, Mississippi, went a step further than those of Huntsville, as there representatives of different political views met in a promotional convention, presided over by Joseph E. Davis, the older brother of Jefferson Davis. At this meeting they organized an association for the encouragement of agriculture and domestic manufactures. The assembled planters agreed to use as many products manufactured of cotton as possible —bagging, blankets, and Negro clothing and "such articles also of our own clothing as may be deemed suitable and adapted to our climate." They further pledged themselves to support and encourage the manufacturing interests of the entire country, and substitute them for foreign imports where the price and quality were equal. As a means of direct encouragement they agreed to pay rewards and premiums, for the goods they could use, to manufacturers submitting such products. They also agreed to promote in every way possible the use of cotton products by residents in other parts of the country and by stimulating the consumption of cotton, increasing its price.(14)

A Mr. Nightingale, who moved from Rhode Island and established a cotton factory in Maury County, Tennessee, soon was furnishing many North Alabama planters with cotton goods which were not available in the Tennessee Valley. This development makes it apparent that the efforts of the Huntsville planters to stimulate the establishment of a weaving mill failed.(15)

While the planters of North Alabama were actively encouraging the growth of industry, other parts of Alabama were also displaying an interest in this type of enterprise. However, some merchants of Mobile and coastal Alabama were hostile to the development of factories in the state, largely because they had a proprietary interest in importing such items as bagging and slave clothing. A group of Mobile citizens joined forces in condemning the adoption of a tariff to protect the infant industry of the country, yet even in this area there was considerable debate before the majority was able to overpower strong resistance of a determined minority, and bring the meeting to vote a resolution of opposition to the tariff.(16)

In Tuscaloosa County, part of the black belt section of the state, there was a growing interest in the advantages that manufacturers, on a local as well as national basis, would introduce. Dugald McFarlane, editor of the Tuscaloosa *Chronicle,* reprinted an article urging planters to employ a part of their slaves in Alabama cotton mills. The author, not a Southerner, pointed to several advant-

ages this system would introduce in serving "to render the slaves more valuable; to secure them more indulgent treatment; to improve their faculties; and accelerate their fitness for final emancipation." The later of these advantages would hardly have appealed to the local planter aristocracy, deeply in debt from slave purchases. Other advantages were apparent in this plan: it would keep at home and in circulation money then expended abroad and in the North; it would stimulate local industry and craftsmen; and it would decrease the overproduction of cotton by taking part of the slaves from the cotton field and placing them in the cotton mill—an improvement which would increase their usefulness as consumers of cotton rather than producers.(17)

The editor of the *Chronicle,* noting the industrial promotion of the North Carolina Legislature in 1828 and the evidence given in tariff hearings before a Congressional committee, wrote a strong editorial in support of the development of cotton manufactures in the vicinity of Tuscaloosa. The opportunity was unlimited for local manufacturers, he said, and concluded that "since they (Southerners) are furnished with the report of the committee of Congress and that of North Carolina, it would seem like obstanicy to continue the purchase of hempen bagging at twenty-five and thirty cents, when it is obvious that they can make *better for fourteen!*" Eastern manufacturers were then making such generous profits by producing finer materials, that they were not particularly interested in this new product and the South could manufacture it without serious competition.(18) Similar efforts by several Georgians were written about by the editor of the *Chronicle* as a means of encouraging Alabamians to take up this type of enterprise. In his opinion this was the only logical recourse for the anti-tariffites and he said "such establishments in Georgia will go further to remove the operation of the tariff than all the angry speeches and unconstitutional resolutions that may be made from now until doomsday." In his opinion the North would no longer support a protective tariff if its effect was to encourage further domestic competition.(19)

The columns of the *Chronicle* reported to the residents of Tuscaloosa the manufacturing advantages of the South, showing that they were so apparent that Northerners were then predicting "that the cotton growing states . . . would . . . become the seat . . . of cotton manufacture." The resources of the section, although undeveloped, were sufficient to make manufactures, flourish and to produce profits; and Southerners, the editor of this journal said,

could not long remain oblivious to their own interests. The rise in manufacture of cotton products in North Carolina[20] and Virginia, and the shipment of textiles to Northern markets was an indication that the experiment could be successful. The fanatic protests of South Carolinians, threatening nullification and secession, were offset in other states by a growing interest in establishing factories, which was said to be "a more . . . agreeable method of counteracting the principal evils of the tariff."[21]

The rising protest in some areas of the South against the tariff did more than any other thing to attract the attention of Southern planters to the advantages of home manufacture and encouraged them to build their own factories. Surely few Alabama planters, despite their opposition to the tariff, were as extreme as South Carolinians. The *Chronicle* published an increasing number of notices regarding the establishment of cotton factories in other Southern States: in Georgia the citizens of Augusta purchased the stock of a proposed cotton mill; even in South Carolina the manufacturing spirit caught the fancy of planters—for one landowner in Edgefield District was reported on his way North to buy mill machinery, and ex-Governor David Williams continued to add to his agricultural profits by spinning his entire cotton crop into yarn and selling it in New York, as he had done with increasing regularity since 1812, when he had established his first cotton spinning mill.[22]

The promotional efforts of Editor McFarlane quickly bore fruit in Tuscaloosa, for in September, 1828 he was able to announce that

> the spirit of domestic economy is at length arousing the energies of the South . . . It is with no little degree of gratification that we have it in our power to inform the public that a company is formed in this town, with a capital of $10,000 for the purpose of establishing a manufactory of Bagging made from the principle (sic) staple of the country.[23]

This factory was expected to be in operation in that year, and local planters would then be freed from their thralldom to Kentucky hemp producers. The editor congratulated the citizens of Alabama for taking the proper course when so many other Southerners were "dissiminating the seeds of discord by inflammatory speeches and resolutions." He said, with pride, that with a single exception there had been no such meetings in Alabama.[24] The Tariff, he pointed out, had the distinct advantage of awakening Southerners to valuable local resources that would not only make them economically independent but also provide the basis for a great industrial development.[25] The Alabama *Advocate* com-

pared the South Carolina Tariff agitation with the disgraceful conduct of the New England states in the Hartford Convention in 1815, and suggested:

> Why not let this doctrine be applied to the present tariff? Why not, instead, in the very outset, of threatening dissolution of the union, let the law go into operation, and if the effects are injurious they will be felt by the people, who alone hold the proper corrective in their own hands? It is for this reason that every candid man must regret to witness the rash and inflammatory speeches by Mr. McDuffie and and others, at the late public meetings in South Carolina, which can result in no good whatever, but must cover the author of them with disgrace, and long remain as a stain upon their patriotism.(26)

The annual message of Governor Murphy, of Alabama, reflected the restraint of the public. He suggested that the only legal action available to the state was the presentation of a "full but temperate memorial to Congress" for a redress of grievances. As for other remedies, he suggested that Alabamians commence at once to manufacture the articles they needed—especially cotton bagging and Negro clothing. He recommended the employment of both slaves and indigent persons in such establishments. Such manufacture would furnish the grower with a local supply of these items through both the domestic system and the factory system. He saw further that this was one method by which the planter might realize a fair return on his cotton. He also noted that slave labor was not subject to the problems of free labor and, that strikes and other labor difficulties could be avoided. Governor Murphy concluded his argument saying that:

> I would therefore respectfully recommend public encouragement to the manufacturer of cotton and woolen fabrics, by the loan of money, the taking of shares, a temporary bounty upon the operations, or by such other and more suitable methods as the wisdom of the general assembly may devise.(27)

The lack of good transportation, and the influence of the protective tariff, produced in the Tennessee Valley the proper combination of encouragement for the establishment of an increasing number of cotton factories.

At Athens, two wealthy planters named I. E. Hobbs and Hubbard Hobbs, put into operation a cotton factory and successfully carried out the experiment urged by so many editors. They built their mill on Swann Creek, at Fulton, halfway between Athens and Mooresville. The editor of the *Athenian* called on the public to give these entrepreneurs every encouragement at their command. As the original intention of these men had been to open a Grist and Saw Mill, they cut a canal to provide the necessary

waterpower. The promotional activities in the area soon convinced them that a spinning mill would also be profitable, and realizing that the waterpower was insufficient for this purpose they decided to employ steam power—the first time this type of power was used in an Alabama cotton factory. Hubbard Hobbs went directly to Wheeling, Virginia, where he looked for a suitable engine. An engine, made to his specifications, was completed in five weeks at Wheeling.

The editor of the *Athenian* described the power plant as follows:

> The whole engine weighs 14 tons. It has three cylindrical boilers 22 feet in length, and 33 inches in diameter. We are informed that the cylinders are 16½ in diameter, with four feet stroke, and when the pressure is of 56 pounds, to the square inch of the boilers, is equal to forty-two horsepower.

The throstle frames and cotton cards, used at Fulton Factory, were purchased by an agent from a factory at Providence, Rhode Island. The mill began operation in the spring of 1829 and by November of that year the proprietors also had added looms for the manufacture of coarse cloth. This cloth, it was explained by the *Athenian* editor, was not as finished in appearance as that of Northern manufacture but this was due to the inexperience of the slave laborers. But the public was assured that what it lacked in looks was made up for in durability.

The proprietors of Fulton Factory were more than satisfied with the slave employees, and it was the opinion of the brothers that the slaves "learn, with considerable facility, even as engineers . . . that, in general, they display as much aptitude as the whites." Not only were the Hobb's adding to local knowledge and convenience with their mill but, as a means of encouraging other manufacturers, they planned—in conjunction with a local machine shop—to manufacture cotton mill machinery.

The editor of the *Athenian*, after making a long report on this new factory, said in conclusion

> We have been unable to obtain the exact cost of the establishment. Many thousands dollars, however, must have been expended by its enterprising owners, and we sincerely hope that a liberal public will not be witholdingn a well timed, and (we will add) a *well-merited*, patronage permit it to have been expended in vain.(28)

By 1830 the experiments of the many small factory owners of the Tennessee Valley and in other parts of Alabama had proved conclusively that the state was a congenial location for cotton manufactures. The spirit of these pioneers was soon reflected by many other Alabamians throughout the state. The state possessed

many encouraging conditions: there was a plentiful supply of cotton; excellent waterpower; and both white and slave labor was abundant and easily trained. Alabama, by 1830, was on the road to great economic diversification, which expanded with each succeeding decade.

Alabama's industrial revolution had begun!

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A Working Paper In The Area Of The Sociology of Religion

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In the following paper I make use of a part of J. Milton Yinger's recent work, *Religion, Society and the Individual* (1), as a basis for working towards a definition of religion from the point of view of the sociologist. While the negative appraisal of the essay portion of Yinger's book may seem to be unfairly critical, the purpose behind my paper is to use Yinger's serious and competent effort to establish some precautions in our formulations regarding the nature of religion. Since Yinger openly espouses the "functional" approach to religious phenomena, it is in accord with what is probably the most popular approach among sociologists towards this facet of human behavior at the present time. Further, my own interest in his approach is conditioned by my concern with value theory and its relationship to the discussion of religion.

My first concern will be a brief presentation of Yinger's approach to the defining of religious behavior, then a few questions will be raised as to the adequacy of this approach and, finally, a few conclusions are stated as to the relevance of the foregoing for the area of the sociology of religion. Yinger, in his attempt to deal with the religious, suggests there are three types of definitions: 1) *valuative*, stating what religion "ought" to be; 2) *descriptive*, detailing historical entities; and 3) *functional*, reference being to the whole range of religious phenomena in human societies. He holds definitions of the first type, valuative, as being inappropriate for the scientist for they are fundamentally of a non-scientific character—an expression of values held, a judgment of value. Descriptive or subtantive definitions are too limited; they are of use when concerned with specific religions as historical and cultural facts, their nature at some given time and place. For religious phenomena as pan-human phenomena, a functional definition is needed, he asserts, and it is a definition of the latter variety which Yinger essays, (2).

A functional definition, Yinger claims, focusses on process, on differences and similarities in religious systems, and attempts to perceive religion not alone as a cultural fact but as having signi-

ficance for personality and society. His criteria for the adequacy of a functional definition is not that of "truth" but that it better serve the needs of current scientific work than valuative or substantive definitions.

In leading up to his definition of religion, he warns against a definition tied to individual religious experience, to the religion of one's own culture or that which is found in a culture similar to one's own. Cautioning against circular reasoning, he points out that if we define a religion by what we believe to be its functions, it wouldn't be too surprising to find it functional. In seeking to evade this error, he suggests religion is an *effort*—he italicizes the word—to perform certain functions for man. Next, he claims not all efforts to perform this function can be considered religious, for he is going to consider only those efforts religious which can be identified as such because of their "intensity" or their "ultimate" quality and by their performing several related functions. He, here, recognizes room for functional alternatives, so suggests there may be that phenomena which can be considered as marginally religious.

Starting with Paul Tillich's view that religion has to do with ultimate concerns, Yinger proposes life's meaning, coping with forces beyond empiricist knowledge, and the containment of hostility and egocentricity within the requisites of group existence as being examples of such ultimate concerns. These, he suggests, constitute deep-seated emotional needs which find their origin in the nature of man. A system of beliefs and practices whereby a group of people struggle with the ultimate problems of human living, then, can be considered a religion. He claims that religious beliefs and rites come from those who have felt these ultimate problems of human living most intensively, and, due to their emotional strength, have returned answers commensurate with the profoundness of the fundamental questions or problems. These returned answers have frequently gone beyond the "natural" and "man's senses," but they have provided relief for the believer. Yinger believes answers of some sort to such fundamental questions are essential for human living, but he appropriately hesitates to claim that any particular rationale provides an adequate framework. Rational efforts are made, of course, to provide answers as well as individual emotional reactions to such essentially religious contexts as evil, suffering and hostility; but religious figures seek closure by a "leap of faith"—an explanation when no other means provide for such closure. From this view,

religion as means of response and adjustment to problematic contexts is residual in character. Further, this religious behavior is a permanent feature of society, Yinger writes, for these questions persist and constitute ". . . an organized effort to make virtue of our ultimate necessities," (3).

Confronting the problem of an individual system of belief and practice as being possibly religious, Yinger rejects the possibility for he believes a complete religion to be a social phenomenon: it is shared, it takes on many of its most significant aspects only in group interaction, and it can be regarded as such for the emotional well from which it springs, as well as the answers it provides, as being social. Too, the fundamental questions themselves are ultimate because of their impact on human association. He approves of Joachim Wach's designation of the three universal expressions of religion: the system of beliefs, the ritual, and the system of social relationships. The nature of the religious intellectual system should not be misconstrued, Yinger warns, for he regards the intellectual orientation of a religion as a "group of mighty hypotheses," of "over-beliefs," of deductions that leap beyond those admissable by a calm appraisal of the facts. He quotes Durkheim approvingly to the effect that men are destined to live and act by theories which go beyond science or which prematurely complete it.

In the functional approach, Yinger suggests, it is not the nature of the belief which is important for study, but the nature of the believing—the diversity of religious phenomena, for Yinger, reflect varied attempts to deal with the same problem. While some reject beliefs, forms of worship, and group associations regarded as religious, they will inevitably return. Thus the quasi-religious movements of nationalism, Communism, etc., of modern times, and similarly science as a way-of-life (not as method or tested propositions), these as over-beliefs seek to answer such questions as to salvation, the nature of reality and of evil. Yinger admits that important problems of value inevitably arise from the functional approach to religion, but these are questions of choice. It cannot be held that religion in general is a good thing.

In sum, Yinger concludes: "The human individual, blessed (and sometimes cursed) with the power of language, capable, therefore, of anticipating the future, including a foreknowledge of his own death, able to verbalize ideal states, to create standards, is continually threatened with failure, with frustration, with his conception of justice unfulfilled" (4). These problems loom up as overwhelm-

ing—religion attempts to relativize them as part of a larger good and to relativize individual desires and fears by making them subordinate to a conception of absolute good which is more in accord with the common and sometimes contradictory needs and desires of human groups. Religion is double-rooted in fundamental individual and group needs. He writes: ". . . men believe 'more than the facts would allow,' in an effort to sustain life and hope and to give meaning to existence." (5)

Now, prior to the critique portion of this paper, it is advisable to set forth briefly the intellectual vantage from which the criticism (and its negative temper) springs. I have stated my interest in value theory at the start of this paper, and, it should be noted, my own orientation to value phenomena involves no easy separation of fact and value—which runs contrary to the main flow of thought in Western culture. More generally, my stand could be considered as within the strictly sociological (not sociologistic) tradition of the scientific pursuit of knowledge about human behavior as it is related to the social, the symbolic-interactionist position in social psychology, and instrumentalist-pragmatist orientation in philosophy. This personal orientation statement is to suggest bodies of thought brought into connection with Yinger's views on religious phenomena as a means for estimating the worth of his contribution. The responsibility of this formulation and interpretation, of course, is mine and reference to these intellectual positions is not in the way of an excuse for views held, but a recognition of indebtedness as well as a means for clarifying the backdrop to some of the critical statements made.

My first criticism relates Yinger's typology of definitions of religion and his rejection of the valuative type: personally, I believe it is too soon to exclude the scientist from the area of value-judgments. Fully recognizing that the "value-free" approach to science—especially in the social sciences—is a popular stand in our day and is convenient for relieving the scientist of many responsibilities; nevertheless, science is not a matter of democratic vote or popular vote nor an enterprise in dodging responsibility. Too, while cognizant of the problems posed by the idea of so-called "ultimate" or "supreme" values, it appears to me that the mere appearance of such an idea in professionally respectable literature does not guarantee either the existence to which it presumably refers or the form of such ultimates which is more often assumed than discussed. To accept the functional definition of religion does not necessarily exclude the valuative or evaluative—providing, of

course, one does not accept the restrictive covenant of excluding science from the area of value-judgments. I believe one can still cogently and respectably argue that the concern with the religious as pan-human phenomena might very well be inclusive of the development and application of the methods of science in the area of what is designated as the strictly religious.

In Yinger's criteria for adequacy in a functional definition of religion, his emphasis on any religion's importance for personality and society, as well as its existence as a cultural fact, would seem to be stating what most sociologists and anthropologists today assume: the importance of culture for human behavior, individual and collective, and in *all* areas of behavior. More important is his caution on the dangers of egocentrism and ethnocentrism; though, unfortunately for his presentation, he does not adequately warn against what P. W. Bridgman has referred to as the impossibility of transcending the "human reference point" (6), or the possibility of language-cultural limits as in Benjamin Lee Whorf's and other's works (7), or the older cultural-entrapment view as in Znaniecki, Alfred Weber and others. I designate the omission of these latter methodological-philosophical points as unfortunate, for these added considerations would have put Yinger's definitional endeavors more in the forefront of current methodological-philosophical considerations regarding the nature of science and, hence, more helpful wherein he seeks to be helpful: not in the area of "truth" but in the area of "current scientific work."

Directly, now, in the area of Yinger's definition of religion, as he defines it, an intense effort or supreme attempt to cope with the ultimate problems of human life by a "leap of faith" which eventuates in a "group of mighty hypotheses" or "over-beliefs"—such a definition almost seems to strain to give added sanction and status to questionable or tentative or out-on-a-limb speculations in admittedly important areas by the grace of earnestness, abandonment of reason, or strength of emotional commitment, as well as suggesting that ideas in these areas, as ideas, are above the usual criteria of adequacy applicable to ideas in general or compared with ideas in what are evaluated as less-important areas. Contrary to the spirit of Yinger's declarations about value-judgments being excluded from his so-called functional definition of religion, his definition of the religious is crassly evaluational and the more tragic for its character seems to have escaped its initiator.

If I read Yinger's intent correctly, his emphasis on the emo-

tionally distraught, or the degree of intensity experienced, when man confronts some of his more abstract and fundamental perplexities (evil, suffering, death, etc.), when distinguishing the religious from the non-religious, this constitutes a perpetuation of two important but dubious elements in the intellecual heritage of the West: first, genius (here, religious) as verging on, or wallowing in, the depths of madness (8); and second, mind or thought as apart and different from emotion. As these elements enter into Yinger's criteria of the religious, he seems to be arguing—I hope I do not do him an injustice, but how else are such phrases as "acutely sensitive," "burst the bonds of man's senses," "enormous burden of tragedy unallayed and hostility unrestrained," to be construed?—that the mark of the truly religious are those who are emotionally upset and, in that state, transgress the boundaries of controlled and disciplined thought in finding answers to some of man's fundamental problems. Is not Yinger doing what he said he was not going to do? Is he not providing a valuative definition of religion? Basically, has he not said: emotional disturbance leading to a "leap of faith" rather than rationality, this is religious; contrariwise, disciplined emotion or panic denied and intellectual formulations within the bounds of what seems justified, this is non-religious? It is also of interest to note that he distinguishes the religious from the non-religious figures by the twin criteria of those who have felt life's problems "most intensely" and who are possessed of "emotional strength," for it is precisely in the area of human emotions that we confront numerous and as yet irresolved problems of identification and mensuration. Report to an area of obscurity for distinguishing and explaining the religious is hardly a happy procedure. This is a report to what has been referred to as "Tests by Affective Congrunce" or the view that the emotional content or sense of conviction accompanying a thought pattern in some way is a validation of it. (9)

If the above constitutes a sound criticism of Yinger's contribution to the defining of the nature of the religious, is the criticism of use in working towards a more adequate definition of religion for use in the area of the sociology of religion? I would suggest that is a possibility in that, first, it stresses the importance of the value topic for the social scientist—the need for care that they do not creep in, unknown to us, into our work; but, to be noted at once, this does not suggest that they are necessarily inappropriate in our scientific work. Further, it suggests the need for working to-

wards a better understanding of the nature of human values themselves as an aid to avoiding such unrecognized intrusions. Secondly, and most fundamentally, in attempting to designate the religious, care must be exercised, as Yinger appropriately notes, to avoid defining the religious on too-limited cultural grounds. Unfortunately, it seems to me, he violated his own precaution. While it is quite true that much of what might be designated as the religious in our society, and in many contemporary and past societies as well, has been and is involved with "excessive" or "uncontrolled" emotional states along with the abandonment of some of the prevailing standards for competent thought when concerned with some of the human being's more abstract, yet crucial, problems; nevertheless, this by no means excludes the possibility that we might find it scientifically useful to include within the area of the religious the more sober and intellectually disciplined behavior that attempts to cope with these same important issues in human living.

* * *

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THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

(Affiliated with A.A.A.S.)

OFFICE OF THE EDITOR
ALABAMA COLLEGE
MONTEVALLO, ALABAMA

VOLUME 30 JANUARY, 1959 NUMBER 3

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The Journal of the Alabama Academy of Science is published four times each year, in July, October, January, and April, and is sent without charge to all members of the Academy.

CONTENTS

SPLENIC WEIGHT AND BLOOD FLOW CHANGES*

KENNETH OTTIS and HAROLD D. GREEN

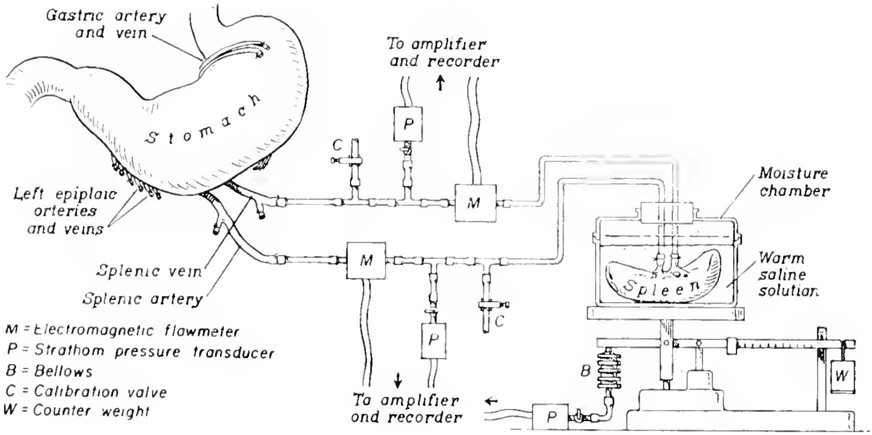
Alabama Polytechnic Institute, Auburn, Alabama, and Bowman Gray School of Medicine, Winston-Salem, N. C.

The present study was undertaken to provide quantitative data relative to the control of splenic weight and blood flow exerted by splenic adrenergic fibers as compared with adrenal medullary hormones, epinephrine and arterenol, and to gain some insight into the possible sympathetic mediator of this organ.

Fifteen mongrel dogs, unselected as to age and sex and varying in weight from 20-26 kg., were used in this study; satisfactory data were obtained from six of these. Surgery and instrumentation were essentially the same as in a previous investigation (1957), with the exception of the moist chamber and weighing apparatus. Concomitant with the cannulazation of the splenic vessels and sectioning of the splenic nerve, the spleen was placed in a plastic receptacle (Fig. 1) which contained warm saline maintained at body temperature. The plastic moist chamber was placed on the weighing apparatus. The weighing apparatus consisted of a triple beam balance arranged so that the pan weight rested upon a Siphlon Bellows of 2.5 cm. in length and 2.5 cm. in diameter. The bellows was filled with water and connected with a Statham venous strain gauge and Brush Analyzer. The preparation was counterbalanced to a negative 50 gm. and allowed to rest on the bellows. The weighing apparatus was periodically calibrated by placing weights upon the moist chamber and noting the consequent weight deflection. A Grass Stimulator set at a frequency of 20/sec., duration 20/sec.., and an intensity of 5 v. was used for all splenic nerve stimulation since these times gave maximum response with minimum voltage. Epinephrine 3.9 micrograms and arterenol 3.0 micrograms were injected intraarterially, the epinephrine dosage being equimolar with the 3.0 micrograms of arterenol (base). These doses most clearly duplicated the response to splenic nerve stimulation. Continuous recording of all experimental results were made on a Brush, six-channel, ink-writing recorder.

Results: The initial response to adrenergic nerve stimulation revealed a primary decrease in inflow, a sharp increase in outflow,

*Supported by NIH grant H-487.



and an immediate loss of splenic weight. Secondarily, the arterial inflow increased, remained above control level for a prolonged time while the outflow decreased below control flow. The minimum weight was reached about the time the flows crossed the control level and this was followed by a very slow return of the splenic weight to control status.

The response to epinephrine, arterenol and adrenergic stimulation were similar. All three brought about a sharp decrease in inflow within 30 seconds. Arterenol and nerve stimulation returned to control in 2 minutes and epinephrine within 6.5 minutes. All three induced a prolonged secondary dilation from the 7th to the 10th minute period. The three agents caused a significant increase in outflow at the 30 sec. period, adrenergic nerve stimulation being the most effective in this respect. All three returned to control at the 1.5 minute period followed by a phase of decreased flow.

Epinephrine and splenic nerve stimulation were about equally effective in causing weight decrease at the 1 minute period with epinephrine continuing to be effective to the 5.5 minute period. Arterenol induced a weight decrease of about half the above magnitude which peaked at 1.25 minutes and was back to control at the 5 minute period. With all three, the splenic weight returned to control level without overshoot.

The net change in flow was computed from the area on the flow record between the flow line recorded during the experi-

mental period and the base line of the flow line recorded during the control period and was expressed in ml. The duration of the area was measured from the onset of the response to the point where the outflow curve crossed the base line established in the control period. This point usually coincided with the minimum point on the weight curve and preceded the return of the inflow curve to the control level. The area, expressed in ml. on the outflow record subtracted from the corresponding area on the inflow curve, was consistently within 10 per cent of the maximum change in splenic weight during the same time interval.

Discussion

Adrenergic nerve stimulation, epinephrine and, to a lesser extent, arterenol reduced splenic weight and increased outflow concomittantly with a smaller reduction of inflow. Nerve stimulation and epinephrine appeared to have a much more significant "emptying" effect than did arterenol. These dynamic changes could conceivably be due to: (a) nerve stimulation and epinephrine causing a constriction of both the smooth muscle of the arterioles and of the trabeculi of the spleen, (b) selective action of arterenol on the smooth muscle of the arterioles with a lesser effect on the smooth muscle of the splenic trabeculi. It is rather irrelevant to debate whether sympathetic fibers or adrenal medullary hormones control the size of the spleen as appears in the literature, but rather which medullary hormone is the mediator of splenic nerve function. It would appear from this study that epinephrine more nearly duplicates the action of splenic nerve stimulation. However, this does not rule out the possibility that splenic constriction and dilation was not the product of both of these adrenergic substances. Arterenol is the principal substance in the splenic venous blood after nerve stimulation; however there is still the probability that the spleen is controlled in a "stand by" condition by arterenol and in "emergency" situations by the mediator epinephrine. This problem is under continuing study in our laboratory. With the aid of adrenergic blocking compounds we hope to shed more light on this subject.

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RELATION OF OXIDATION RATES TO NITRIC ACID CONCENTRATION FOR SOME BITUMINOUS COALS, COKES AND A LIGNITE

REYNOLD Q. SHOTTS

University of Alabama, University, Alabama

The subject matter of this paper is an outgrowth from a continuation of previous work by the author dealing with rates of nitric acid oxidation of coal and the resulting information on its petrographic composition (1, 2, 3, 4). In most of the work, nitric acid of 8 normal concentration was used exclusively. In one test, however, a series of oxidations were run with 4N acid and the results indicated the possibility that the resulting slower rates of oxidation delineated petrographic components more closely.[3] In order to determine the specific influence of concentration of oxidant it was decided to oxidize a series of coals of varying rank for a short period (0.50 hours) and to determine the per cent of alkali-insoluble residue for various acid concentrations.

The proximate analyses, sulfur content, heating value and method of preparation of these coals is shown in Table 1. Shown also are the fixed carbon and heating values on the dry, mineral matter-free basis.

Although admittedly an over simplification, coal can be considered as made up of two broad petrographic classes, "bright" coal and other types. Because both chemical and petrographic composition are known to influence the oxidation rates, a further series of runs was made in which an attempt was made to separate the samples into fractions of similar petrographic composition prior to testing. The ideal sample would, of course, be one of a pure petrographic constituent but obtaining such a sample is extremely difficult. However, bright coal is nearly always lower in specific gravity than the other components, both inherently and by virtue of its generally lower mineral matter content, and a reasonable approach to isolation of a pure bright coal fraction may be accompiished by float-sink separation in a solution with a specific gravity of around 1.28 to 1.32. The analyses of these fractions are shown in Table 2. Reference to the ash content shows that little mineral matter was included in any of the samples. Results of oxidation studies on all samples are given in Table 3.

Discussion of Results

Figure 1 shows a plot on a linear scale of acid normality against alkali-insoluble residue for whole coal samples oxidized for 0.50 hours in the first series of tests. The curve for the medium temperature coke (190B) is notably irregular. In general, the lower the rank of the coal, the farther to the left the curve falls on the graph. The curves for 185B and 186B are drawn as if they, at no concentration, would yield more than 100 per cent residue. This is not necessarily true because there are no data for normalities less than two and both coals had residues much below 100 per cent at a normality of two.

The same data are plotted in Figure 2 except that, in this case, the logarithm of the normality is plotted against the logarithm of the alkali-insoluble residue. The results are reasonably compatible with a log-log relationship, particularly if all points showing more than 100 per cent residue are ignored.

The results from 0.50 hours oxidations of float and sink fractions of six coals are plotted on linear coordinates in Figure 3. Comparison of these curves with those of Figure 1 show a more uniform spacing of curves according to rank and less variation in general shape of curve. Undoubtedly, the shape of some of the

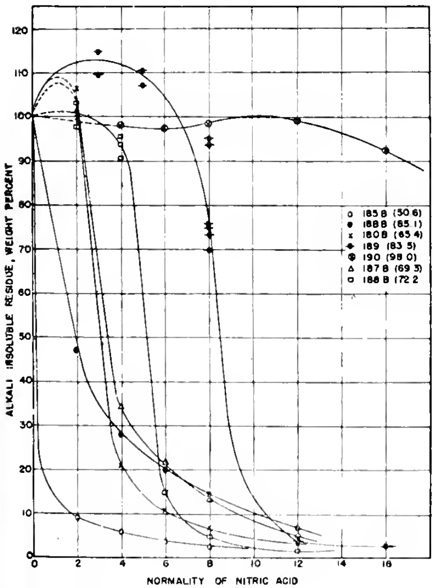

Figure 1

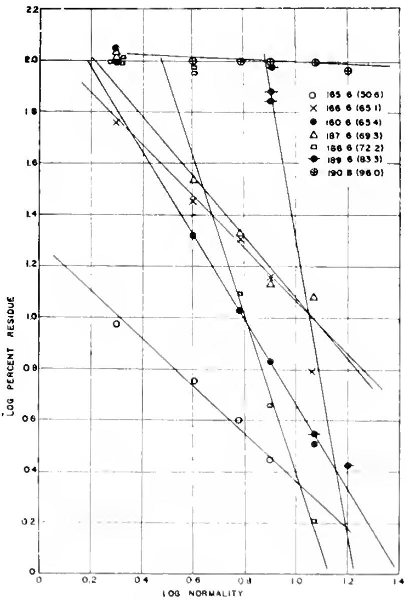

Figure 2

curves in Figure 1 may be ascribed to the greater heterogenity of substances being oxidized.

The dearth of residues shown on Figure 3, between values of 30 per cent and 100 per cent is somewhat unexpected. Apparently when sufficient concentration of nitric acid was used for oxidation actually to "take hold," it proceeded quite rapidly. This fact will be referred to again.

Figure 4 is the plot on log-log coordinates of the second series of test results. Except for sample 195B, the fit of the points to a straight line is little better than that shown in Figure 2. Residues left by 14N and 16N acid were very small and the points seldom are consistent with the others.

Possible Nature of the Oxidation Reaction

The first definition of oxidation given to a freshman chemistry student carries the idea that oxygen atoms unite with other atoms or that oxygen is "added to" another substance. Often gain-in-weight experiments such as Lavoisier's oxidation of mercury are used for illustration. It is stressed that a new substance is formed, having properties different from those of the parent substances.

1. In the case of coal, it is possible that oxygen atoms are at

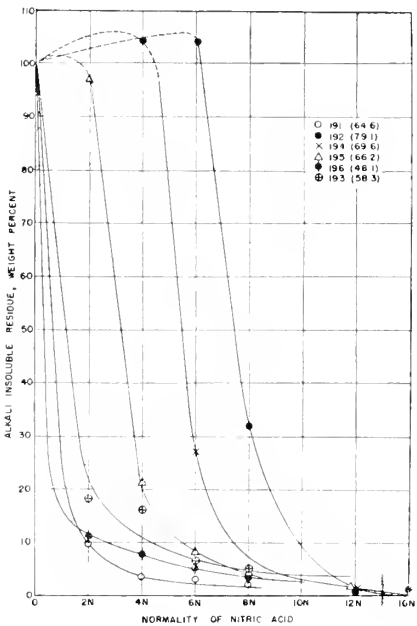

Figure 3

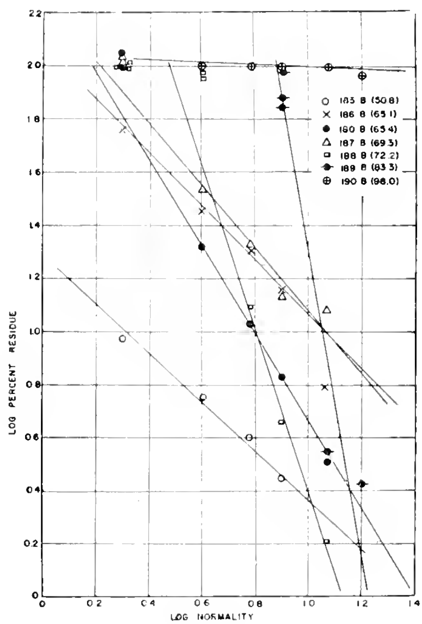

Figure 4

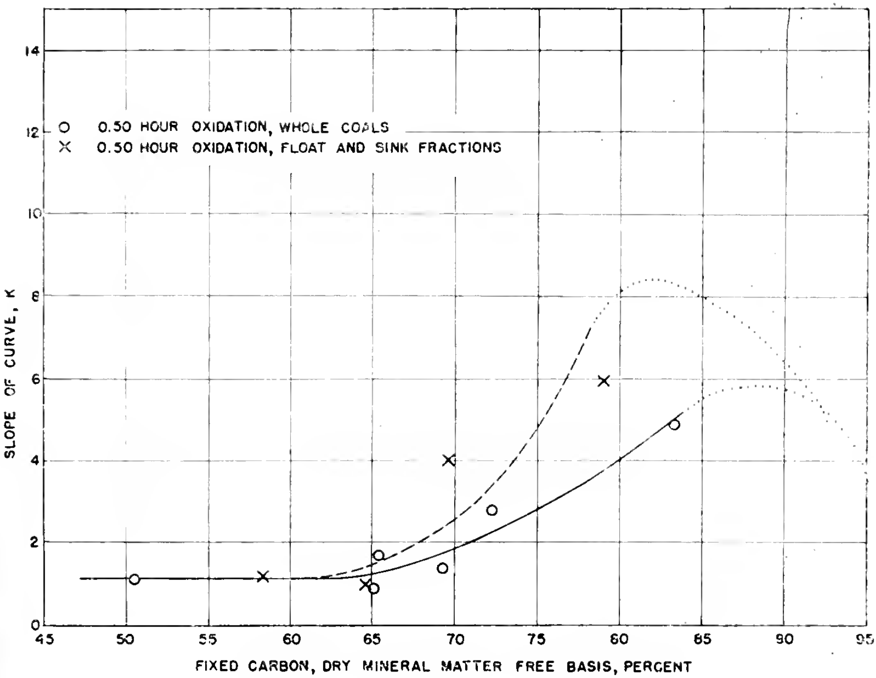

Figure 5

first added rather loosely to the coal "molecular" structure resulting, in some instances, in weight gains. It has been suggested by many writers that coal has an essentially aromatic structure with carbon rings as the basis and with other groups, particularly those containing oxygen and perhaps organic sulfur and nitrogen, bound to the rings periferally. It has been shown that aromatization or condensed carbon structures increases with rank(5). The attached oxygen may not, at first, form definite compounds but merely loosely bound complexes such as some of the intermediate complexes which have been postulated to explain experimental data obtained in combustion reactions(6). Such complexes, or even true compounds if such are formed, may not be alkali-soluable. If, however, oxidation is more intensive (higher concentration or temperature) or exposure time is longer or if the aromatic structure is more readily invaded (lower rank coals), compounds may be formed which have a structure that renders the malkali-soluble. In such instances, weight losses are noted.

2. Another possibility is that opposing reactions are proceeding simultaneously, one of which is a reaction in which oxygen is

being added, as postulated above, and the other is one of internal rearrangement or of separation of groups which will lead to alkali-soluble compounds. Under conditions such as a highly condensed structure, short periods of contact, low temperatures, or low con-concentration of nitric acid and K is a constant representing the under opposite conditions the second one predominates and alkali-soluble material is formed.

As suggested above, there is some evidence that for each coal some critical acid concentration may exist at which oxidation appears to "take hold" and proceed rapidly. This could be interpreted as the point at which the oxygen group—detaching reaction becomes predominant over the oxygen—addition reaction.

In either case, there should exist oxidation conditions under which addition compounds form that are not alkali-soluble and which will result in residues heavier than the original sample of unoxidized coal even when fairly low rank coals are oxidized. Recent unpublished work at the Souhtern Experiment Station of the U.S. Bureau of Mines, located on the University of Alabama campus, indicates that prolonged oxidation at temperatures much below the boiling point of the nitric acid solution will give this result.

If the formation of alkali-soluble material by nitric acid actually follows a log-log relation with regard to acid concentration, the relation between these variables is of the form $R=C^K$ or log $R=K$ log C where R is the per cent alkali-insoluble residue, C is the centration of reactant, the first reaction may predominate whereas slope of the curve connecting concentration and residue for a given coal. For the coals tested, values of K ranged from 1 to 6. If some portion of certain samples consists of material that cannot be oxidized at all by any concentration of acid, such a rule could not hold strictly. All the residue calculations had moisture and inorganic material eliminated but it is known that fusain and some other organic substances found even in predominently bright coals are extremely resistant to nitric acid oxidation(2).

The relation of concentration of acid to rank is shown by the spacing of the curves or the graphs, as indicated above. To obtain additional information on this relation the data for each coal were plotted individually on log-log paper (plots not shown), a straight line was drawn and the slope measured. Figure 5 is a plot of these slopes as a function of the dry mineral matter-free fixed carbon content of the samples. From 48 to about 65 per cent dmmf

fixed carbon, the inclination of the lines differs very little with rank. Although the points are distributed somewhat irregularly, there is a definite increase in slope beyond 65 per cent dmmf fixed carbon. If full weight is given to the results for the sample of coke, the curve apparently passes through a maximum at a dmmf value of around 85 per cent and falls rapidly to zero for dmmf values of approximately 98. However, few geologists or fuel technologists at present would agree that there is much relationship between the metamorphic processes that determined rank and the pyrolysis of coals to produce char or coke, although there has been support for that position in the past and experimental work has been done to attempt to form a uniform series of products from coal to coke.

Conclusions

1. The rapidity with which nitric acid solutions oxidize bituminous coals decreases markedly with decrease in nitric acid concentration.

2. The quantity of alkali-soluble material which nitric acid of a given concentration produces in a given length of time decreases steadily with increase in rank or degree of metamorphism of bituminous coals.

3. Nitric acids of low concentration and/or coals of high rank, when reacting at refluxing temperature, may yield alkali-insoluble residues which exceed in weight that of the original sample of unoxidized coal.

4. These phenomena may be explained either as (a) a reaction in which acid concentration and/or other conditions (particularly time and temperature) must exceed some critical value to produce alkali-soluble products of oxidation or (b) two competing reactions, one in which oxygen is added to the coal structure without producing alkali-solubility and another in which rearrangement or decomposition produces alkali-soluble substances, the nature of the end products depending upon which of the reactions predominates under the test conditions.

5. It is possible that under conditions of concentration, temperature, and susceptability to complete oxidation of so-called "humic acids," a logrithmic relation exists between the weight of insoluble residue remaining and the concentration of the acid.

6. Nitric acid oxidation rates may provide a better means of ranking coals as to degree of geological metamorphism than the

criteria now used so long as differences in petrographic composition are understood or controlled. The writer believes that petrographic differences within a given coal sample must have been determined largely by initial differences in plant matter, or in its condition and composition at the time biological processes became subordinate to metamorphic or dynamic forces, sometime after burial, after which rank changes in a given petrographic constituent were produced primarily by the forces and factors of metamorphism.

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance of the University of Alabama Research Committee through a grant which financed the experimental work on the project.

Thanks are due also to Dr. John B. Gayle, United States Bureau of Mines, for many valuable suggestions and for reading and reviewing the manuscript.

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LIST OF ILLUSTRATIONS

Table 1
Proximate Analyses of Whole Coal Samples Subjected
To 0.50 Hours Oxidation

	Sample	Air Dry Basis						Unit Coal Basis		
Bed	No.	M	A	VM	FC	S	Btu	FC	Btu	Preparation
Lignite (1)	185B	6.3	10.6	42.1	41.0	4.9	9,530	50.6	11,670	Raw, mine run
Black Creek	186B	1.4	8.3	31.7	58.6	0.8	13,326	65.6	14,890	Raw 1½"x0 wash.
Milldale	180B	0.9	4.0	33.4	61.7	1.4	14,610	65.4	15,470	Raw, mine run
Mary Lee	187B	0.8	14.5	27.0	57.7	1.1	13,740	72.2	15,500	Raw—48x80
Clements	188B	1.4	9.0	25.7	63.9	1.1	13,740	72.2	15,500	Raw—48/80
Pocahontas #3	189B	0.4	7.2	16.2	76.2	0.8	14,560	83.3	15,880	Probably raw, bright coal
Clements	190B	1.4	8.2	4.0	86.4		-	95.6(2)	-	Med. temp. coke (3)

(1) From cut in A.T.&N. R.R. 5 miles south York, Sumter Co., Alabama.

(2) Dry ash-free basis

(3) Prepared from a 20 gm sample of coke in a U. S. Steel High Temperature Assay Apparatus. Temperature measurements indicated only about 800 degrees C.

Table 2

Proximate Analyses of Low Specific Gravity (float Fractions of Coals Subjected to 0.50 Hours Oxidation

	Sample	Air Dry Basis						Unit Coal Basis		
Bed	No.	M	A	VM	FC	S	Btu	FC	Btu	Preparation
Lignite (1)	196B	30.5	7.9	32.6	29.0	3.0	7,410	48.1	12,450	Float 1.30
Corona	193B	2.8	4.4	39.2	53.6	1.6	13,420	58.3	14,570	Float 1.32
Jagger	191B	4.0	3.0	33.2	59.8	0.7	13,200	64.6	14,240	Float 1.32
Jefferson	195B	0.8	2.2	33.3	63.7	1.5	14,730	66.2	15,270	Float 1.31
Pratt	194B	1.9	2.5	29.4	66.2	1.0	14,930	69.6	15,690	Float 1.30
Pocahontas #3	192B	0.8	12	20.7	77.3	0.6	15,360	79.1	15,710	Float 1.30

(1) Outcrop on Landrums Creek, near Ala. Highway 79, Marengo Co., Ala., as received basis.

TABLE 3

Percent of Alkali-Insoluble Residue Left After Oxidation at Various Acid Concentrations

Sample No. & dmmf FC, %	Normality of acid	% of residue	Slope of curve K
0.50 hour oxidations of whole coals			
185B	2	9.3	1.1
50.6	4	5.8	
	6	4.1	
	8	2.6	
186B	2	47.6	0.9
65.1	4	28.1	
	6	20.0	
	8	14.2	
	12	6.6	
	12R	6.6	
180B	2	99.7	1.7
65.4	2R	107.4	
	2R	98.2	
	4	20.7	
	6	10.7	
	8	6.7	
	12 (1)	3.2	
187B	2	101.1	1.4
69.3	2R	105.8	
	4	34.1	
	6	21.5	
	12	4.8	
	12	4.8	
188B	2	102.8	2.8
72.2	2R	99.5	
	2R	97.8	
	4	93.5	
	4R	90.5	
	4R	95.2	
	4R	95.2	
	6	12.1	
	8	4.6	
	12	1.6	
189B	4	109.5	4.9
83.3	4R	114.9	
	6	107.2	
	6	110.7	
	8	75.0	
	8	73.3	
	8	75.4	
	8	95.2	
	8	70.0	
	12	3.5	
	16	2.7	
190B	4	98.0	—
98.0	6	97.5	
	8	98.6	
	12	99.4	
	16	92.2	
0.50 hour oxidations of flaat & sink fractions			
196B	2	11.1	1.1
48.1	4	7.9	
	6	5.4	
	8	3.1	
193B	2	18.3	1.2
58.3	4	16.1	
	6	6.4	
	8	4.5	
191B	2	9.5	1.0
64.6	4	3.3	
	6	3.0	
	8	2.2	
195B	2	97.0	2.2
66.2	2R	121.5	
	4	21.0	
	6	8.0	
	8	3.8	
	12	1.7	
194B	6	27.1	4.0
69.6	8	6.7	
	12	1.4	
	16	0.5	
192B	4	108.1	6.0
79.1	4R	106.5	
	6	106.2	
	6R	106.0	
	6R	105.3	
	8	31.9	
	12	0.8	
	16	0.7	

(1) Known faulty results.

A PRELIMINARY GEOLOGICAL AND ARCHAEOLOGICAL SURVEY OF THE WEISS DAM RESERVOIR*

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The writers spent forty-three days, from June 26 to October 19, 1956, in the search for geological and archaeological sites in the Coosa Valley of Cherokee County.

The area searched will be the reservoir for the Weiss Dam that will be constructed at Leesburg by the Alabama Power Company. Actual work on the dam will not begin until a license has been granted by the Federal Power Commission; however, preliminary surveying and core drilling have been done. After construction begins it has been estimated that it will take two years to complete the dam. This dam will be one of a series that will be constructed along the Coosa River in order to fully develop its power potential. This development will also assist in flood control and navigation.

In all, 305 Indian village and flint sites were discovered near the Coosa, Little, and Chattooga Rivers. Of these, twenty were recommended for excavation. A complete report on the archaeology of this prolific artifact area is planned by the Alabama Museum of Natural History after excavation of the most important sites.

Dam and Reservoir

The structures of the dam will consist of a concrete gated spillway section with compacted earth abutment dikes. At the top of the gates the elevation will be 572 feet above sea level while the power pool elevation, 558 to 564 feet. With the tailwater elevation at full capacity at 517 feet above set level, an operating height of 47 to 41 feet will be obtained to develop an average annual energy of 215.5 million kilowatt hours.

A diversion canal approximately four miles in length will be constructed across Pollards Bend, a twenty mile bend of the river below the dam. It may be adapted to navigation by installing a lock near the power plant at the lower end. At full power pool (564 feet above sea level) the reservoir will have an area of 27,400 acres extending approximately 52 miles to the existing Mayo's Bar Lock and Dam near Rome, Ga. A controlled surcharge storage of 378,300 acre-feet above the full power pool will be provided for the

*Paper presented in April, 1957.

control of floods. With an operating height of 47 to 41 feet, the initial installation will generate 56,000 kilowatts in two units.

Topography and Geology

The Weiss Dam Reservoir will occupy the central portion of Cherokee County. Cherokee County may be divided roughly into three parts topographically; the ridges and valleys in the northern part; the central part known as the "Flatwoods" occupied by the Coosa River; and the southern part, a highly faulted area with resistant formations standing out as prominent ridges and knobs.

The central or "Flatwoods" area of Cherokee County is underlain by the Conasauga formation which is composed of shale, limestone, and calcareous shale. The elevation of this area ranges from 500 to 650 feet above sea level. The area is drained mainly by the Coosa, Little and Chattooga Rivers and Terrapin Creek. Along the banks of these streams and on the flood plains the easily tilled, rich sandy soil provided ideal village sites for the aboriginals.

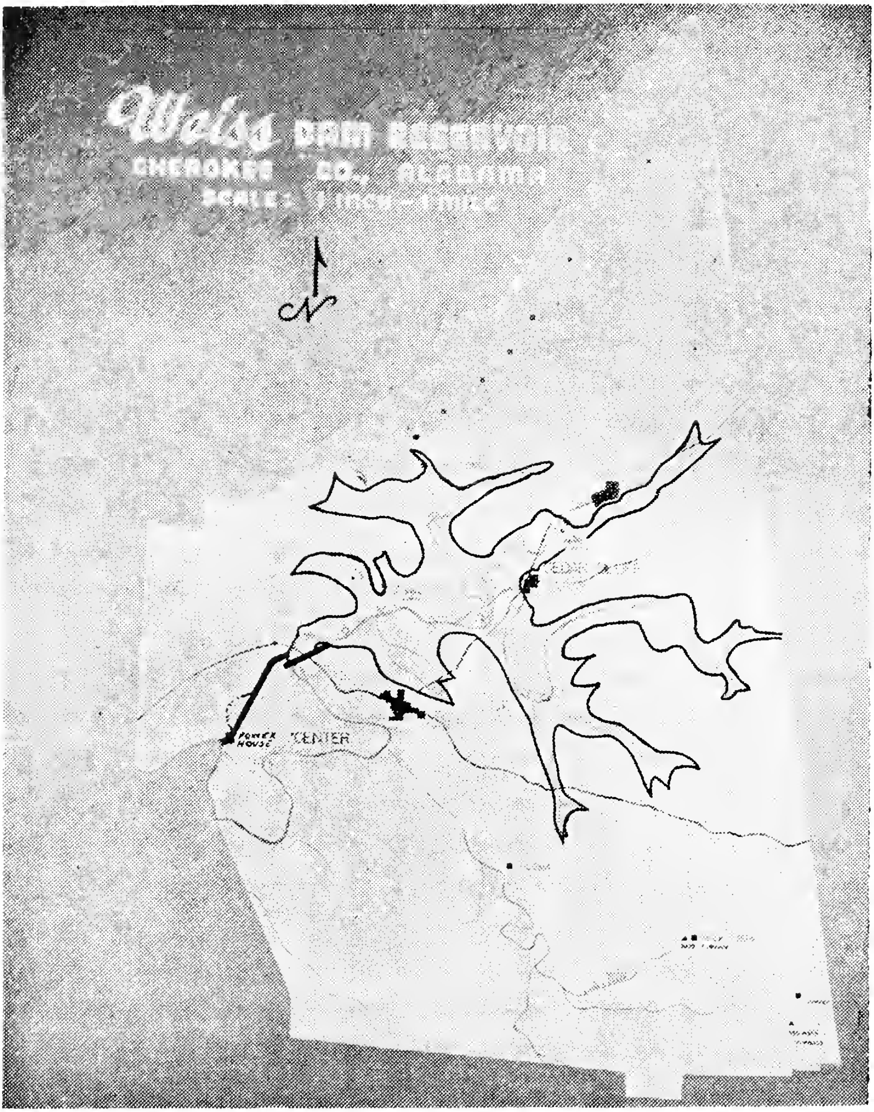
Somewhat varied and intermittent, yet relatively important, mining in Cherokee County has contributed to the economy of the State and especially to the South during the war between the states. The red iron ore of the Red Mountain formation in Shinbone Ridge has been exploited extensively as evidenced by the old mining areas from Chesterfield south to Firestone. Round Mountain, a small isolated hill five miles west of Cedar Bluff, was mined since the early 1850's; however, the easily available ore has apparently been all mined out. Tucker Ridge or Dirtseller Mountain also provided ore for use in the furnaces in Cherokee County.

The Round Mountain Furnace, situated at the foot of Round Mountain, was one of the earliest in northeastern Alabama and was first put in operation in April 1852. The ore used was the red fossiliferous iron ore from the side of Round Mountain. Production was about 2½ tons of iron daily. This furnace was the first in Alabama to make use of the red ore which produced a very high grade iron. It was blown out in December 1906.

Cornwall Furnace is situated about two and one-half miles north of Cedar Bluff in a large bend of the Chattooga River. A canal was dug from one side of the bend to thefurnace, and a tunnel was dug under the hill behind the furnace to the other side of the bend. This allowed enough drop to develop water power to run the blowing engines for the blast furnace as well as a grist and flour mill. Red ore from Dirtseller Mountain three miles away supplied the furnace. The furnace went into blast late in 1862 or early in the Spring of 1863 with a daily production of about 5 to 8 tons. In the Summer

of 1864 General Blair of the Union Army burned all of the furnace that would burn. After the war it was rebuilt, but production never exceeded 5 tons and it never proved financially successful. After changing ownership and management several times, it was blown out for the last time in 1875.

Three other furnaces have been in operation in Cherokee County; Tecumseh Furnace, Stonewall Furnace and Rock Run Furnace, all in the southeastern corner of the county. Only the Rock Run Fur-



nace operated during the war between the states, the other two being built after the war.

Indian Sites

In searching for the Indian sites several methods were utilized; however, the area was so prolific in artifacts that almost all likely looking spots turned out to be either a flint or village site. The sites were usually located on river bottom terraces and ridges whose elevations were usually at or near the high power pool elevation of 564 feet. All likely looking areas which will be surrounded by water or below an elevation of 565 feet above sea level were also checked. TeTrraces and ridges near river banks and sprins proved to be very good locations for village sites, whereas areas not relatively close to water were usually bare of artifacts. A rapid examination facilitated by the cultivation of the fields was given all accessible areas that were not covered by weeds and leaves.

The type and quantity of artifacts scattered over the surface were the basis for classifying a site as a village or flint site. A village site was established by the presence of one or more potsherds and numerous flint chips and points. Under this system a burial site would be classified as a village site. If only flint material were found it was classified as a flint site. Of the 305 sites discovered, 80 were classified as village sites. These were the most important dwelling areas of the aboriginals and compose the list of sites recommended for excavation.

Location, dimensions, topography, cultivation, material collected, collector, nearest approach by automobile, feasibility of excavation, etc., were recorded on standard Alabama Museum of Natural History forms which are on file at Mound State Monument. All sites were located and recorded on Alabama Power Company sheets Nos. 5, 6, 7, 8, 9, 10, and 15, Coosa River Development F. P. C. Project No. 2146.

Artifacts Found on the Various Sites

flint chips	arrow points	spear points
stone knives	scrappers	scrapers
hammerstones	beads	potsherds
unidentified bone	gorgets	pipe fragments
pendants	discoidals	celts
mussel shells	snail shells	spades
stone axes	sandstone discs	galena balls
flint drills		

Conclusion

Many geological and archaeological sites will be inundated. The famous Conasauga limestone trilobite beds along the bank of the

Coosa River at Cedar Bluff will be covered as well as the rich farm lands in the bends of the river. Cornwall furnace which is still standing in fair shape will be partially inundated, and the remains of the Old Round Mountain furnace will probably be washed by waves from the waters of the reservoir. Even if the greatest effort is made to excavate all the important aboriginal sites before flooding no doubt many will be untouched. .

Few, if any, important mineral deposits will be inundated by the Weiss Reservoir. The Conasauga limestone underlies most of the flooded area and its shaly and weathered character makes it unsuitable for the usual uses of limestone. The Red Mountain formation is exposed principally on hills and will not be under water.

This dam as a part of the project undertaken by the Alabama Power Company to harness the water power of the Coosa River represents a great step in the progress of developing our natural resources.

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EVIDENCE OF ABIOTIC OXYGEN UPTAKE BY MARINE SEDIMENTS

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The following report concerns an investigation of an aspect of production in an ecosystem which seems to have been neglected or overlooked by reporters of previous investigations. This view is that of the part played by purely physical changes as opposed to biochemical changes in a productive milieu. Attention to the matter of photochemical changes independent of photosynthesis was suggested by Posner (1956) in a seminar at the Duke University Marine Laboratory. Posner reviewed personal communications that he had had with Rice and Odum (1956) concerning some factors that could possibly affect production. It was stated that Odum had made the suggestion that photochemical synthesis might be a probable cause of oxygen up-take. It was also shown that Rice (Personal communication to Posner) had suspected an inhibition to production in microcosmic ecosystems that he had observed. Whether this restraining influence was antibiotic or due to crowding was not made clear by the seminar leader, Posner.

With the Riley-Nielson-Ryther controversy concerning production as measured in BOD bottles very much a current topic and then this fresh approach, as suggested above, the writer resolved to make at least a preliminary investigation of abiotic oxygen up-take.

The following series of experiments is an attempt to add to the overall understanding of changes in oxygen concentrations where there is no living matter to produce oxygen or take up oxygen by respiration.

V. S. Ivlev (1945) says that purely chemical oxidation apparently does not take place in water. However, he did not give any basis for this assumption. Hence, it was thought that a good starting point would be to take an autoclaved series of BOD bottles containing both seawater and marine sediments and subject them to the standard routine for production measurements as if they actually contained living organisms, phytoplankton in particular.

METHODS

The experiments reported here were carried out in two series, one following the other by a period of one day. The first experiments were set up by filling 12 BOD bottles with marine sediment

and seawater. This assembly of sediment and water was autoclaved for a period of 30 minutes at a steam pressure of 18 lbs psi. The seal on the autoclave was not broken for twelve hours while the temperature came to that of the surrounding air. It was thought that enough oxygen would 'lead' in during the waiting period to cause the water to reach a stable oxygen content, which would, in turn, enable one to measure the oxygen content. The whole assembly was withdrawn from the autoclave at the end of 12 hours from the start of the experiment. Four of the bottles were immediately titrated (Winkler Method) upon withdrawal from the autoclave. The other eight bottles, 4 dark, 4 light, were placed in a lagoon near the laboratory, at a depth of ¾ m., for 24 hours. They were then examined for oxygen. The results of this experiment follow:

Bottle Number		Mg. 0_2/L
# 4	Control	0.50
#11	Do.	0.95
# 2	Do.	0.75
# 7	Do.	1.20
# 9	24 hrs. in lagoon, light	0.00
#10	Do.	0.00
#13	Do.	0.00
# 5	Do.	0.00
#12	24 hrs. in lagoon, dark	0.00
# 1	Do.	0.00
# 8	Do.	0.00
# 3	Do.	0.00

TABLE I

The results of the first series of experiments. Note that there was 0^2 present at the beginning of the experiment—None when the bottles were removed from lagoon.

The results of the foregoing tests were so surprising that it was thought best to continue the study with refinement of technique and additional experiments as checks and controls.

METHODS SECOND SERIES

A—Eighteen bottles of sediment and seawater were treated exactly the same as those in the first series so far as sterilization goes. There was a change in routine as related to placing the bottles in the lagoon.

Six of the bottles, three light, three dark, were submerged in

seawater and allowed to stand in a glass tank on the laboratory porch for 8½ hours in full daylight.

Eight of these bottles were placed in a wire basket and suspended in the sea at a depth of ¾ m. for a period of 10½ hours. 4 dark, 4 light.

Four bottles were titrated upon withdrawal from the autoclave.

As a control to part 'A' four extra bottles were filled under exactly the same circumstances and at the same time. These were titrated for oxygen while the heat was building up on the autoclave that held the other eighteen bottles. The following results were obtained:

Bottle Number	Mg. 0_2/L
#20	2.30
#17	2.25
#18	2.35
#19	2.40

TABLE II

SECOND SERIES—A. Four bottles with sediment and seawater, unautoclaved—a control.

Bottle Number		Mg. 0_2/L
# 2	Light	0.45
# 1	"	0.60
# 8	"	1.60
# 3	Dark	0.90
#17	"	0.25
#132	"	0.00

TABLE III

SECOND SERIES—A. Six bottles, three dark, three light, allowed to stand on lab porch 8½ hrs. Note no significant difference in light and dark bottles.

Bottle Number		Mg. 0_2/L
#12	Light	0.00
# 7	Light	0.00
#141	Light	0.00
#11	Light	0.00
# 2	Dark	0.00
# 4	Dark	0.00
#125	Dark	0.00
# 5	Dark	0.00

TABLE IV

SECOND SERIES—A. Eight bottles, four light, four dark suspended in sea from pier at Duke Marine Lab. 10½ hrs. Note all 0_2 taken up.

B—Series Two.

METHOD: The object of this experiment was to test the oxygen up-take of an absolutely inert substance. Since time and availability of appropriate materials were at a premium, activated charcoal and boiled sand were used. Nine bottles were used in this test. All were filled with seawater and/or charcoal, or sand. All were allowed to stand five hours after filling. Three of the bottles had untreated seawater, three had activated charcoal covered with untreated seawater, three had boiled sand covered with untreated seawater. Results after standing 5 hrs. Winkler titration.

Bottle Number	**Mg. 0_2/L**
(Control)	
# 1	6.60
# 2	6.60
# 3	6.50
(Activated Charcoal)	
# 4	5.70
# 5	5.60
# 6	5.30
(Boiled Sand)	
#141	6.45
#11	4.85
# 5	6.00

TABLE V

SECOND SERIES—B. A nine bottle experiment. All were retained in the laboratory for a period of five hours. All had the same amount of light. Significant absorption by charcoal. Possible significance indicated by boiled sand.

C—Series Two.

Object: To determine something about the rate of oxygen uptake of raw sediment.

METHOD: A laboratory bucket was filled with sediment and seawater. It was allowed to settle for a few minutes (Until a clear sample of water could be collected). Then a series of tests of the

supernatant water for oxygen was made. Two more series were made at intervals of four and twelve hours. Results:

Test	Mg 0_2/L
No. 1	6.7
1 hr. later	1.30
4 hrs. later	0.30
12 hrs. later	0.14

SECOND SERIES—C. Successive determinations for oxygen in open lab bucket. Values are averages for three determinations each trial and time interval.

DISCUSSION

There was not a great deal of literature available to the writer at the time of this hurried study. However, Zobell (1946) says that the redox potential probably influences the diagenesis of bottom deposits in many ways. No attempt to assess the Eh of the sediments was made during this study. Another intriguing idea was suggested in a paper by Zobell and Anderson (1946). In this study they considered the influence of surface on the population of bacterial cultures. They found that greater surface per volume gave larger population densities and concluded that the surface was one of a place of attachment rather than a nutrient factor inasmuch as they tested different nutrient concentrations.

Juday (1943) stated that the bottle method of oxygen demand determination was suspect in his discussion of experiments at Little John Lake, Wisconsin.

Edmondson (1956) in discussing the photosynthetic rate as a function of light intensity makes mention of the Riley-Steemann Nielson-Ryther controversy. Voccaro and Ryther (1954) also studied bacterial effects in light and dark bottles. They concluded that there was no differentiation in effects in light and dark bottles. Inasmuch as 'Production' is very much currently in vogue in the English-speaking scientific world (Dissart, 1951) the results of this study should be of interest as a point of departure to some student of production.

This study shows emphatically that there is an oxygen uptake independent of organic life, within the limits of the experimental technique employed in this series of experiments. It is not meant to imply that no possible errors exist.

The facts as set forth in the data included here are subject to the critical analysis of whether there were any residual living bacteria.

If not, was the oxygen depletion due to chemical oxidation because of activation by heat and the presence of a low oxidation state of some of the sedimentary material. Could the depletion of the oxygen have been due to the absorption of the gas on the particulate matter? Such questions are difficult to answer. It is evident that there is a significant difference in the oxygen disappearance in the test with the activated charcoal, while the results from the boiled sand might be interpreted as not showing a significant depletion on standing in the laboratory five hours.

In terms of the charcoal and sand, however, a tentative explanation is offered in terms of a possible absorption of the oxygen on the sediment particles. Zobell's experiment where the bacterial population was more dense in respect to greater surface area would tend to confirm this; if one would but consider that the bacteria fasten to the sides of the vessel because there is more available oxygen there in the first place and hence a more suitable environment. Then too the ecologist will confirm the presence of organisms living in the sea-sediments that have iron hemoglobin. Certainly one would think that the oxygen demand of such organisms would be relatively large. If there is not considerable oxygen available, how does such an animal keep up his respiration needs?

SUMMARY AND CONCLUSION

Mud and water were sterilized in an autoclave. The oxygen content was measured after removal from the autoclave. The oxygen content was measured after standing in relatively constant temperature environment. There was less oxygen after standing. Where did the oxygen go?

In view of Ivlev's statement previously cited, Lzobell's experience with the bacteria, the suspect nature of BOD determination by the black and light bottle methods, surface tension phenomena as a physical entity, and the results of this experiment, it is concluded, tentatively, that particulate matter has a physical oxygen demand that is possibly of the nature of absorption.

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COMPANY STRUCTURE AND UNIONIZATION

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Unions have been less successful generally in their organizing campaigns in the South than in the other regions of the country. For this reason factors which influence the outcome of organizing efforts should be of special interest to all persons concerned with industrial relations. The present study focuses attention on the possible impact of one of these factors, company structure.

Are unions more successful in organizing single-plant firms or the plants of firms with two or more plant locations? There is some feeling that companies with several plants can shift production from plant to plant and thus defeat organizing drives which would reach their objectives in single-plant firms. If this ability to shift production is effective, and is not offset by other considerations, an analysis of the extent of unionization among Southern plants should reveal a higher degree of unionization among single-plant firms than among the plants of multiple-plant firms. It is the objective of this paper to determine whether or not in fact such differences in unionization are found in Southern industry.

Sources of data

Data for the study are drawn from material collected in three questionnaire surveys of Southern industry. The first, made in 1952, covered 600 plants scattered from Maryland to Louisiana and employing nearly one-half million workers. Most of these plants are located in Alabama, Georgia, North Carolina, Tennessee and Virginia. The second and third surveys, made in 1954, were confined to fertilizer and dairy firms in Alabama. These two groups of plants, numbering 27 and 37, respectively, employed approximately 3,000 workers. In total, then, 664 plants are included in the investigation.

Several limitations of the data need to be made clear before the

results of the surveys can be fruitfully examined. The returns received probably overstate the extent of unionization in two ways. First, the key question involved read, "Is your establishment unionized in part or in whole?" While this question apparently presented little difficulty of interpretation for company officials, it does lump together firms fully organized and those only partially organized. Second, study of the returns from Alabama indicates that a greater proportion of "large" firms (i.e., those employing 500 or more workers) than of "small" firms responded. Since unionization appears to be closely correlated with greater size, as the information in Table 1 columns 4 and 5 suggests, unionized firms are probably over-represented in the sample. To reduce this bias and to isolate the effect of interrelated forces, the returns have been classified in various combinations to achieve greater comparability. In all, nine different comparisons are made of groups of plants classified on the basis of company structure, industry group, specific industry, plant size, location of company headquarters and the use of organized personnel departments and/or full-time personnel workers. This approach makes it possible to compare the extent of unionization in single-plants and branch-plants at nine different levels of comparability of the constituent plants. These efforts in turn, however, have resulted in small samples for many of the comparisons.

The basic comparison

Unionization is significantly[1] greater among the branch plants than among the single-plants included in the general survey of 600 plants, as is shown in Table 1. About one-fourth of the single-plants, but more than one-half of the branch-plants are unionized in part or in whole. This great difference in unionization, however, is at least partially due to factors other than company structure.

Differences among industries

Unionization in the South varies greatly from industry to industry;[2] therefore, classification of the plants by industry groups and individual industries would be expected to reveal the varying degrees of unionization which can be seen in Table 1. In each of the eight **industry groups** presented, unionization is more widespread in the branch-plants than in single-plants. The differences are significant in four industry groups: food and kindred; textile and apparel; chemical, fertilizer, paper and rubber; and primary and fabricated metals.

When the **individual industries** listed in Table 1 are examined, 25 comparisons are found. In 18 of these, unionization is greater in branch-plants than in single-plants. In three industries, the spin-

ning and weaving, fertilizer, and naval stores, the differences are statistically significant. In two more industries, there is **no** difference in the extent of unionization. Thus, in only five industries is unionization greater in the single-plants than among the branch-plants, and in none of these instances is the difference significant.

These comparisons, however, are subject to important limitations. First, branch-plants are usually larger than single-plants and larger plants are more widely unionized than are smaller plants, as the data in Table 1, columns four through seven, strongly suggest. Second, branch-plants are more likely to have personnel departments and full-time personnel workers than are single plants, and unionization is more widespread in plants with such "personnel specialization" than in plants without "personnel specialization."[3] To reduce size and personnel specialization differences, and thus meet these objections, the plants included in the general survey were reclassified as shown in Table 2.

Plants comparable in size and personnel specialization

The comparisons in Table 2 again show a consistently greater percentage of unionization in branch-plants than in single-plants. Among the smaller plants the differences are significant. The fact that the differences, though present, are not significant among the larger plants suggests that company structure may have little influence on unionization once the plant involved reaches a given size. The differences found in all four of the comparisons, however, may be attributable to industry differences in the samples, rather than to company structure. To partially meet this problem, the comparisons in Table 3 have been made.

Plans comparable in industry and size

Data in columns 1 through 4 of Table 3 contrast groups of branch-plants and single-plants which are comparable in industry group or industry **and** size. For the **industry groups**, there are only 14 comparisons, there being no large single-plants in the stone and clay products and transportation and public utility industry groups. In 12 of these comparisons, unionization is greater in the branch than in the single-plants. In five of the 12 instances, the differences are significant. Only among the small wood processing and miscellaneous plants, is unionization higher in the single than in the branch-plants.

The same columns in Table 3 yield 28 comparisons for **specific industries.** In 17 of these cases, unionization is greater in the branch-plants. For two other industries, equal unionization is found. Only in the nine remaining industries is unionization higher in the single-

plants. None of the differences shown for individual industries in these columns are significant.

Thus, among plants comparable in size **and** industry group or industry, unionization emerges as more widespread among the branch-plants.

Plants comparable in industry and personnel specialization

Comparisons of plants comparable in industry group or industry **and** in personnel specialization are given in columns 5 through 8 of Table 3. In 11 of 13 comparisons for **industry groups,** unionization is greater among the branch-plants. In four instances, the differences are significant. Only in the comparisons for the wood processing, and stone and clay products plants, both **without** personnel specialization, is unionization higher among the single-plants, and then not significantly higher.

Specific industry comparisons in the same columns produce 26 cases. In 13 of these, unionization is higher in the branch-plants than in the single-plants, significantly so in two instances. There are four ties. In nine cases, unionization is higher among the single-plants, but not significantly higher.

According to the data presented, among plants comparable in industry **and** personnel specialization, as well as among plants comparable in industry and size, unionization is greater among the branch-plants than among the single-plants.

Plants comparable in industry, size and personnel specialization

The classification criteria used in Table 3 were combined to produce the comparisons in Table 4. Here are groups of plants comparable in industry group or industry, size **and** personnel specialization.

The data of Table 4 yield 23 comparisons for **industry groups.** Of these, 16 show unionization as higher in the branch-plants than in the single-plants. In three of these instances, the differences are significant. There is one tie. In the six remaining industry group comparisons, five of which involve small plants, unionization is greater among the single than among the branch-plants, but not significantly greater.

There are 36 comparisons for **specific industries** in Table 4. In 18 of these, constituting one-half of the cases, the percentage of unionization is higher among the branch-plants than among the single-plants. In 10 comparisons the percentages are equal for types of plants. Only in eight cases is unionization higher among the single-plants than among the branch-plants. None of the differences found in these 36 comparisons are statistically significant.

Once again for both industry groups and individual industries,

unionization appears to be more extensive in branch-plants than in single-plants, even when both groups of plants are comparable in industry, size and personnel specialization.

Plants comparable in industry and location of company headquarters

Because unionization appears to be greater among plants of companies with headquarters outside the South[4] than among plants of firms with headquarters in the South, only the latter were included in the comparisons presented in columns one and two of Table 5. In six of the eight **industry-group** comparisons given, unionization is higher among the branch-plants than among the single-plants. The differences are significant for two groups, the textile and apparel, and chemical, fertilizer, paper and rubber groups.

There are also 17 comparisons for **individual industries** in columns one and two of Table 5. In 11 instances the percentage of unionization is higher among the branch-plants than among the single-plants. For the fertilizer and spinning and weaving industries the differences are significant. In six cases, unionization is greater among the single-plants.

Overall, these comparisons indicate that when plants comparable in industry and location of company headquarters are contrasted, unionization will be found to be greater in the branch-plants, ordinarily, than in the single-plants.

Plants comparable in industry, size and location of company headquarters

To refine these last comparisons, the data in columns three and four of Table 5 were brought together. These figures contrast plants comparable in industry group or individual industry, size (i.e. all are "large") and location of company headquarters. In five of the six **industry-group** comparisons, the percentage of unionization is higher among the branch-plants than among the single-plants, but there are no significant differences. In only six of the 13 comparisons of **individual industries**, however, is unionization higher among the branch-plants. In seven industries, unionization is more widespread among the single-plants than among the branch-plants. These individual industry comparisons are the first which show greater unionization among single-plants than among branch-plants in a **majority** of the industries for which data are available. It should be noted, however, that none of the differences are statistically significant.

Plants comparable in industry, location of company headquarters, size and personal specialization

The most detailed comparisons of the study are presented in Table 5, columns five through twelve. Here are contrasted plants comparable in industry group or industry, location of company headquarters, size and personnel specialization. The sub-dividing process has reduced the number of plants in many of the samples so that in some instances even great differences in percentages are not statistically significant.

For the **industry groups**, there are 23 comparisons. In 10 of these, unionization is higher among the branch-plants than among the single-plants. Significant differences are found in one comparison each for the textile and apparel, and chemical, fertilizer, paper and rubber groups. In two comparisons the percentages are equal, but in 11 industry groups, unionization is higher among the single-plants than among the branch. None of these last differences, however, are statistically significant.

There are 29 comparisons of **individual industries** in columns five through twelve. In 13 of these, unionization is greater in the branch-plants. In eight cases, the percentages are equal. In the eight remaining industries, the extent of unionization is greater among the single-plants. None of the differences in these 29 comparisons are statistically significant.

The groups of plants under analysis here are more closely comparable than those previously contrasted. Thus it is especially important to note that these comparisons reveal only minor differences in the number of industry groups or industries in which unionization is found to be greater in either branch-plants or in single-plants. In general evaluation, however, such differences as are found favor the thesis that unions are more successful in organizing branch-plants, than single-plants.

Unionization by industry group and individual industry

Analysis of the data presented in Tables 3, 4 and 5 by industry group and individual industry may bring out important variations by industry in the extent of unionization as influenced by company structure.

Food and kindred: In 12 of the 14 comparisons given in the Tables 3, 4 and 5 for food and kindred industries, unionization is greater among the branch-plants. In three comparisons the differences are significant.

For the **bakeries**, there are seven comparisons. In three cases the percentages are equal, but in the four others, the percentage of

unionization is greater among the branch-plants. In the 14 comparisons for the **dairy** industry there are no significant differences, but in 12 instances the extent of unionization is greater among the branch-plants. Ties prevail in the other two cases. The comments of one dairy manager who was interviewed on this subject may help explain these results. As he sees it, "Employees in branch-plant firms feel that the company is so large that the managers don't know each man individually so they don't take the interest in them that managers in small plants do. They have to have the assurance through a union that their job is considered important."

In sharp contrast to the results for the dairy industry, the comparisons for the **meat** industry show that in six of eight instances unionization is higher among the single than among the branch-plants. In the two remaining comparisons the percentage of unionization is equal in one case and is higher among the branch-plants in the other case. None of these eight differences are significant, however.

Textile and apparel: There are 14 comparisons for this industry group. Of these, 13 reveal a greater extent of unionization among the branch-plants. Four of these differences are significant.

In eight of 11 comparisons for the **garment** industry, unionization is higher in the branch-plants, but not significantly so. Percenttages are equal in two cases, and in only one comparison is unionization higher among the single-plants. The picture for the **spinning and weaving** plants is very similar. In 13 of 14 comparisons, unionization is more widespread in the branch-plants, significantly so in one case.

In contrast to the situation in the garment and spinning and weaving industries, unionization is greater among the single-plants than among the branch-plants in the **knitting** industry in six of nine comparisons. In one case the percentages are equal. In the remaining two instances unionization is greater among the branch-plants.

Wood processing: In this industry group, unionization is generally greater among the single-plants. This is true in 10 of the 14 comparisons. Of the four remaining comparisons only two reveal greater unionization among the branch-plants. There are no significant differences, however.

Examination of the data for individual industries shows that among the **furniture and casket** plants, unionization is higher in the single-plants in five of the seven comparisons. Again there are no significant differences. The two remaining comparisons of the seven are ties. Similarly among the **lumber** plants, unionization is higher in the single-plants in 12 of 14 comparisons, but in no case signifi-

cantly. In the other two comparisons the percentages for both types of plants are equal. It is perhaps noteworthy that the wood processing plants, in most cases, are relatively small and their capital investment per worker is quite low.[5] These factors may enable branch-plant firms in these industries to combat unionization more effectively by shifting production from plant to plant than is possible for firms with larger investments per worker and larger plants.

Chemical, fertilizer, paper and rubber: In 12 of the 14 comparisons for this industry group, unionization is more widespread among the branch-plants than among the single-plants and in eight instances the differences are significant.

For the **fertilizer** plants, 11 comparisons are presented. In nine of these, unionization is higher in the branch-plants, significantly higher in two instances. The two remaining comparisons carry an equal percentage. One fertilizer company official who was interviewed explains the differences this way, "Practically every operator I know with two or more plant locations is unionized. The greater the number of plant locations a company has, the harder the union representatives try to organize them. Naturally they want the dues. If a union gets one plant, it is comparatively easy to get another plant of that company. If a union representative goes to an unorganized unit and he san say that his union represents the men at another plant in the same company, he has a strong point with the workers. It's salesmanship."

In each of the five comparisons for the **industrial chemical** plants, the extent of unionization is greater among the branch-plants. But none of the differences are significant. As an industry official sees it, "The ability to control a majority of plants in a national organization is helpful. It gives leverage to a union. A union with leverage to negotiate has the power to get other plants. Pension and group insurance plans work better with big coverage, so unions with few plants [in a company] follow the pattern set by the company and the 'prime' union. Furthermore, chemical plants are hard to move. Textile plants **can** be moved. They can run away from unions, but the equipment for chemical plants is so specialized it can't be used for other purposes and is so expensive that duplicate plants can't be built and production shifted among them."

Data for the **paper pulp** plants, reveal that unionization is more widespread among single-plants than among branch-plants in each of the six comparisons. These plants are large and the capital invested per worker great; therefore, an explanation for the rela-

tively high degree of unionization in single paper pulp plants cannot be found in low capitalization and small size.

Stone and clay products: The percentage of unionization is higher among the branch plants in four of the eight comparisons for the stone and clay products industry group. In an equal number of comparisons it is higher among the single-plants. Again none of the differences are significant.

Among the **brick and clay products** plants unionization is higher in branch-plants in four of seven comparisons. In the remaining three comparisons, the percentages are equal.

Primary and fabricated metal: Unionization is greater among branch-plants in nine of the twelve comparisons for this industry group, significantly greater in one instance. In the remaining three comparisons unionization is higher, but not significantly higher, among the single-plants.

In all six of the comparisons for the **basic steel and aluminum** plants, unionization is greater among the branch-plants. None of these differences, however, are significant, nor are there any significant differences among the 12 comparisons for the **foundry** plants. Six of these comparisons favor branch-plants, and five, single-plants. None of the differences for the **machinery** plants are significant either. Two of five comparisons show higher unionization among the branch-plants, two reveal ties and the last shows greater unionization among the single-plants. For the **structural steel** plants there are seven comparisons. Of these, five favor the branch-plants, and the remaining two are ties. Only among the **light metal fabrication** plants is unionization greater in the single-plants in most comparisons, though in no instance is the difference statistically significant. Five of the six comparisons for this industry favor the single-plants; the last favors the branch-plants.

Transportation and public utilities: In each of the two comparisons for this industry group, unionization is greater but not significantly in the branch-plants than in the single-plants.

Miscellaneous: In six of nine comparisons for the miscellaneous industry group, unionization is greater in the branch-plants. In only three cases is unionization higher in the single-plants. In no instance is the difference statistically significant.

Summary and conclusions

The numerous comparisons presented in this paper may be summarized thus: First, among the 600 plants in the 1952 survey and among **all** the plants in each of the eight industry groups, shown in Table 1, unionization is greater in the branch-plants than in the sin-

gle-plants. These differences are statistically significant for the food and kindred, textile and apparel, chemical, fertilizer, paper and rubber, and primary and fabricated metals industry groups. Second, there are a total of 87 comparisons of classified plants in **industry groups** in Tables 3, 4, and 5. In 60 of these unionization is greater in the branch-plants, significantly so in 16 instances. There are ties in three instances and in the remaining 24, unionization is greater but not significantly greater in single-plants. Third, for **individual industries,** there are a total of 149 comparisons. In 78 of these, unionization is greater in the branch-plants, significantly so in three instances. There are 24 ties, and in 47 cases unionization is higher in the single-plants. Of these last differences, however, none are significant.

A remarkably consistent picture emerges as the data are classified and reclassified to achieve higher levels of comparability. Nine different levels are presented, eight levels using two or more of the criteria of: industry group, industry, plant size, location of company headquarters and personnel specialization. In all but two sets of sub-comparisons, one involving individual industries and the other industry groups, the extent of unionization is greater in a majority of the cases in branch-plants than in single-plants, though the degree of difference appears to decline as the degree of comparability of the plants contrasted increases. This analysis suggests that of any large group of Southern plants selected at random a substantially higher proportion of the branch-plants than of the single-plants would be organized. This difference, would be attributable largely to differences in industry, size, personnel specialization and the location of company headquarters, but **also in part to differences in company structure.**

The comparisons also highlight the differences in industry patterns of unionization. In only one **industry group,** wood processing, is unionization more widespread among the single-plants than among the branch-plants. Among the **individual industries,** in six, the meat, knitting, furniture and caskets, lumber, paper pulp and light metal fabrication industries, unionization is higher in the single-plants than in the branch-plants in a majority of the comparisons. In the remaining seven industry groups and eleven specific industries compared in Tables 4, 5 and 6 unionization is higher among the branch-plants.

This result should not be altogether surprising. There are reasons why a higher degree of unionization in branch-plants might be expected. As has been suggested, the branch-plant may be **more attractive** to union organizers than comparable single-plants. Organ-

izing a branch-plant gives the union an entree into other plants of the same company. It may give the union desired leverage in bargaining with a national company, especially on such programs as pensions and group insurance. It may also enable the union to fight back against company efforts to shift production from organized plants to unorganized plants during a strike.

In addition, branch-plants may be **easier to organize.** In branch-plant companies the distance between workers and top management is ordinarily greater than in single-plants, a fact which may well increase the workers' receptivity to the union as a communications system. Managers in larger companies usually have had broader and more varied experiences so that unionization may not appear to them as the catastrophic event that it may seem to be to the managers of single-plant firms. Furthermore, once the union has organized the first unit within a multiple-plant company, it may find employer resistance reduced and employee acceptance increased as it tries for additional units. In contrast, in organizing each new single-plant, the union representative must go through the whole procedure again from the beginning. If other plant managers in a particular multiple-plant company are bargaining with a given union, it can hardly be a breach of principle for the branch-manager whose workers are currently being organized also to agree to bargain with that union. If workers in another plant of the company are winning gains through a given union, why shouldn't the workers in "this" plant? Apparently "it **can** be done." Such arguments at least appear to have sales value.

The thesis of this paper can be restated simply. Shifting of production from plant to plant in multiple-plant firms is undoubtedly an effective technique in warding off unionization. Its effectiveness in many cases, however, is apparently more than offset by the greater attractiveness of branch-plants to unions and, possibly, by the greater ease of organizing them, especially after a union has won the first plant of a company.

FOOTNOTES AND LITERATURE CITATIONS

1. The differences in extent of unionization revealed by this study have been tested by the chi square method to discover those instances which would occur by chance fewer than five or ten times a hundred pairs of samples of constant sizes were drawn from the same universe.
2. Steele, Myles, and McIntyre, "Personnel Practices in the South," *Industrial and Labor Relations Review*. 9: (No. 2) 245. 1956.
3. Steele, Myles and McIntyre, "Unions and Personnel Departments in Southern Industries," *Advanced Management*. 21: (No. 10) 15-17. 1956. and "Structural and Regional Influences on Personnel Practices," **Jour. of Ala. Academy of Science,** 27:79. 1955.
4. South is defined here to include Alabama, Arkansas, Florida, Georgia,

Table 1. **Extent of Unionization in Classified Plants in Selected Southern Industries**

	Number of plants	Percentage Unionized in part or in whole		Aver. no. of employees		Aver. no. of employees		Dividing line between large and small plants
		Branch	Single	Union	Non-union	Branch	Single	
Industry Group or Industry	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All plants in general (1952) survey	600	55*	26	1,187	487			
Food asd kindred #	93	45*	24	152	97	150	87	
Bakery	11	50	0	296	176			200
Bottling	7	33	0	76	96			300
Cotton seed and peanut oil	7	67	50	223	71			150
Dairy ***	37	96	29	86	51			50
Flour mill	4	100	0	403	165			200
Meat	12	40	50	182	73			100
Textile and apparel	156	27*	5	1,450	870	1,257	301	
Garment	27	23	7	225	204			250
Knitting	15	38	14	1,194	265			250
Spinning and weaving	103	27*	0	1,714	1,239			500
Wood Processing	90	26	16	517	144	453	130	
Crates	4	0	33	200	104			250
Furniture and caskets	10	25	33	927	544			500
Lumber	55	8	12	293	113			250
Naval stores	3	100**	0	200	65			250

Table 1 (continued)

	Number of plants	Percentage Unionized in part or in whole		Aver. no. of employees		Aver. no. of employees		Dividing line between large and small plants
		Branch	Single	Union	Non-union	Branch	Single	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chemical, fertilizer, paper, rubber	85	74*	22	1,277	584	1,524	553	
Fertilizer***	27	75*	16	42	23			30
Industrial chemical	18	82	0	1,229	98			250
Paper bags and boxes	6	50	50	224	205			250
Paper pulp	14	80	100	1,237	2,117			1,000
Stone and clay products	23	88	83	183	91	206	73	
Brick and clay products	10	100	75	165	53			150
Primary and fabricated metals	98	82*	57	1,318	274	1,401	418	
Basic steel and aluminum	9	100	50	5,508	900			500
Foundries	31	75	67	527	372			500
Light metal fabrication	19	67	50	245	118			200
Machinery	12	80	50	871	372			500
Structural steel, plate, and tanks	11	89	50	298	83			500
Transportation and public utilities	16	93	0	3,266	547	4,446	197	
Gas	3	50	0	1,250	547			500
Miscellaneous	12	50	20	113	52	130	72	
Printing and engraving	6	50	50	113	79			200

* Difference significant at the 5 percent level of confidence.

** Difference significant at the 10 percent level.

*** All Alabama plants, surveyed in 1954.

\# Industry group figures include data for individual industries omitted because all plants were branch or single, or union or non-union and thus did not permit comparisons.

Table 2. **EXTENT OF UNIONIZATION IN SOUTHERN PLANTS COMPARABLE IN SIZE AND PERSONNEL SPECIALIZATION**

	Number of plants	Percentage of Plants Unionized Branch plants	Single plants
Plants with 50 to 499 employees			
without personnel specialization	(1)	(2)	(3)
with personnel specialization	208	49*	26
Plants with 500 to 4,900 employees	121	54**	34
without personnel specialization	11	40	0@
with personnel specialization	155	60	50

* Difference significant at the 5 percent level.
** Difference significant at the 10 percent level.
@ Only one plant in this category.

Table 3. **Extent of Unionization in Southern Plants Classified by Industry and Size And By Industry and Personnel Specialization**

Industry Group or Industry	Large Plants		Small Plants		Personnel Specialization Present		Personnel Specialization Absent	
	Branch (1)	Single (2)	Branch (3)	Single (4)	Branch (5)	Single (6)	Branch (7)	Single (8)
Food and kindred	74*	40	25	16	59*	15	37	28
Bakery	100	0	20	0	0	0	57	#
Dairy	67	44	29	20	67	33	29	28
Meat	75	100	17	0	75	#	17	50
Textile and apparel	31	17	17*	0	28	8	21*	3
Garment	33	33	20	0	29	0	17	10
Knitting	40	50	33	0	33	50	50	0
Spinning and weaving	31	0	14	0	28	0	20	0
Wood processing	56	40	7	15	46	33	8	13
Furniture and caskets	50	50	0	25	25	50	#	25
Lumber	25	50	0	10	25	33	0	9
Chemical, fertilizer, paper, rubber	78**	43	67*	13	70*	14	87*	25
Fertilizer	83	40	50	7	0	0	83*	21
Industrial chemical	100	#	70	0	82	#	83	0
Paper pulp	67	100	100	#	80	100	#	#
Stone and clay products	90	#	86	83	100	0	78	100
Brick and clay products	100	#	100	75	100	0	100	100
Primary and fabricated metals	87	75	75**	52	85	79	67	46
Basic steel and aluminum	100	50	100	#	100	50	#	#
Foundry	88	67	63	67	83	86	66	50
Light metal fabrication	75	100	0	38	67	100	#	44
Machinery	80	#	80	50	89	100	0	#
Structural steel, plate, tanks	100	#	83	50	86	0	100	100
Transportation and public utilities	92	#	100	0	93	#	#	0
Miscellaneous	100	0	0	22	#	100	50	11

* Difference significant at the 5 percent level of confidence.
** Difference significant at the 10 percent level.
\# No plants in this category.

Table 4. **Extent of Unionization in Southern Plants Classified by Industry, Size, and Personnel Specialization**

Industry Group or Industry	Large Plants Personnel Specialization				Small Plants Personnel Specialization			
	Present		Absent		Present		Absent	
	Branch (1)	Single (2)	Branch (3)	Single (4)	Branch (5)	Single (6)	Branch (7)	Single (8)
Food and kindred	88*	0	64	55	33	22	21	14
Bakery	#	0	100	#	0	0	25	#
Dairy	75	0	50	50	50	40	20	10
Meat	100	#	50	100	50	#	0	0
Textile and apparel	30	13	38	25	20	0	13	0
Garment	33	0	#	50	25	0	17	0
Knitting	25	50	100	#	50	#	0	0
Spinning and weaving	32	0	29	0	14	0	13	0
Wood processing	63	67	0	0	0	22	9	14
Furniture and caskets	50	50	#	#	0	#	#	25
Lumber	33	100	0	0	0	20	0	9
Chemical, fertilizer, paper, rubber	76	33	86	50	54**	0	88*	0
Fertilizer	#	0	80	50	0	0	100	10
Industrial chemical	100	#	#	#	50	#	83	0
Paper pulp	67	100	#	#	100	#	#	#
Stone and clay products	100	#	75	#	100	0	80	100
Brick and clay products	100	#	100	#	100	0	100	100
Primary and fabricated metals	87	67	#	100	81	88	67	40
Basic steel and aluminum	100	50	#	#	100	#	#	#
Foundry	88	67	#	#	75	100	67	50
Light metal fabrication	75	#	#	#	0	100		29
Machinery	80	#	#	#	100	100	0	
Structural steel, plate, tanks	100	#	#	#	75	0	100	100
Transportation and public utilities	91	#	#	#	100			0
Miscellaneous	#	#	100	0	#	100	0	13

* Difference significant at the 5 percent level of confidence.
** Difference significant at the 10 percent level.
# No plants in this category.

Table 5. **Extent of Unionization in Southern Plants Classified by Industry, Location of Headquarters, Size, and Personnel Specialization**

Industry Group or Industry	Headquarters in South		Large Plants Hqrs. in South		Plants with Headquarters in the South: Small Plants: Personnel Specialization: Present		Absent		Large Plants: Personnel Specialization: Present		Absent	
	Branch	Single	Branch	Single	Branch	Single	Branch	Single	Branch	Single	Branch	Single
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Food and kindred	39	24	62	40	80	0	50	55	17	22	29	14
Bakery	43	0	100	0	#	0	100		0	0	25	
Dairy	46	29	67	44	75	0	50	50	50	40	20	10
Meat	0	50	0	100	#	#	0	100	0	#	#	
Textile and apparel	21*	5	21	17	22	13	0	25	33	0	18*	0
Garment	17	7	0	33	0	0	#	50	#	0	25	0
Knitting	0	14	0	50	0	50	#	#	#	#	#	0
Spinning and weaving	23**	0	23	0	24	0	0	0	33	0	17	0
Wood processing	8	16	25	40	33	67	0	0	0	22	0	14
Furniture & caskets	0	33	0	50	0	50	#	#	#	#	#	25
Lumber	10	12	33	50	50	100	0	0	0	20	0	9
Chemical, fertilizer, paper, rubber	57*	22	60	43	20	33	100	50	0	0	100*	17
Fertilizer	100*	16	100	40	#	0	100	50	#	#		
Industrial chemical	100	0	100	#	100	#	#	#	#	#	100	0
Paper pulp	0	100	0	100	0	100	#	#	100	#	#	#
Stone & clay products	75	83	80	#	100	#	50	#	100	0	50	100
Brick & clay products	100	75	100	#	#	#	#	#	#	0	100	100
Primary & fabricated metals	76	57	87	75	87	67	#	100	78	88	33	40
Basic steel & aluminum	100	50	100	50	100	50	#	#	100	#	#	#
Foundry	56	67	75	67	75	67	#	#	50	100	50	50
Light metal fab.	67	50	67	100	67	#	#	100	#	100	#	29
Machinery	75	50	100	#	100	#	#	#	100	100	0	#
Structural steel, plate tanks	80	50	100	#	100	#	#	#	67	0	#	100
Transportation and public utilities	93	0	91	#	90	#	#	#	100	#	#	0
Miscellaneous	50	20	100	0	#	#	100	0	#	100	0	13

(For footnotes key see Table 4)

Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

5. *The Economic Almanac* (published for the Conference Board by Crowell, New York, 1958). P. 216 shows capital invested per wage earner employed to be $6,255 for "Lumber and furniture products" as compared with $13,157 for "Total manufacturing." Of twelve industry groups only "Leather and products" and "Textiles and their products" reported less.

SOUTHWEST ALABAMA: A GEOGRAPHIC VIEW

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The area of our symposium today is the dominant forest sector of the State. In other aspects, however, mixed trends are illustrated because four different geographic regions are involved. Southwest Alabama, as established by the U. S. Forest Survey, includes all of the Pineywoods and Gulf Coast regions, and parts of the Black Belt and Wiregrass regions (See Figure 1). The 12 counties involved include 25 percent of the area of Alabama and 17 per cent of its 1950 population.

There is thus, a marked discrepancy between percentage of State area and of population, and this difference is increasing. As is shown in Figure 2, Southwest Alabama is primarily an area of decreasing population. Between 1930 and 1950 most of the 221 election precincts of the area lost population; in seven scattered precincts over half of the population moved out. Increase, by contrast, was typical only in the Gulf Coast Region in Baldwin and Mobile Counties, and in precincts having growing cities and towns. Decline in rural population is, therefore, normal for all parts of the area except in the Gulf Coast Region.

Such changes are not new in the area's history. Here were the first two sites for permanent white settlement in the State. The French settlement of Mobile began in 1702 at 27 Mile Bluff on the Mobile River, and moved in 1711 to its present site. The first Anglo-Saxon settlement was near St. Stephens in the late 18th Century, and this was the first capital of Alabama Territory in 1817. An antebellum plantation zone developed in the bottomlands around St. Stephens and Claiborne, head of schooner navigation on the Tombigbee and Alabama rivers. In Reconstruction days, however, farming deserted the bottomlands for the uplands and the old site of St. Stephens has now been abandoned. Relics of these early days still

show on the topographic map in the form of metes and bounds descriptions for land titles. The Black Belt was another area of early settlement, but it also has been losing population for decades.

The distribution of the colored population largely reflects the antebellum plantation pattern. Five counties still have a Negro majority; the three Black Belt counties of Wilcox, Sumter and Marengo were from 69 to 79 per cent colored in 1950, while Choctaw and Monroe had a slight Negro majority. By contrast, the non-plantation areas have few, only 15 per cent in Covington and 22 in Baldwin. Negro, as well as white, exodus from the area has been typical; part of these migrants, however, have contributed to the rapid population growth of Mobile city.

Underlying this emigration of people has been the low income and the low educational status of the area. In 1953 per capita income payments to individuals in Alabama averaged $1,019, with a range from $424 to $1,435 (See Figure 3). Mobile County, with $1,289, was fourth highest in the State, and the only one in the area above the average. The lowest were in the Black Belt counties, Wilcox with $464 being third lowest in the state. The forest core of the area ranged from $552 in Choctaw to $790 in Clarke. The educational status is also low. (See Figure 4). In 1950, for adults aged 25 and over, the median school years completed was 7.9 for Alabama. Only in Baldwin and Mobile in this area was the median 8 years or more. In the Black Belt counties of Wilcox and Sumter it was below 6 years, while in the forest core counties it was below 7 years.

It is obvious, therefore, that, with the exception of the two Gulf Coast counties, this area is not adequately supporting its people. The primary income sources for the population are from agriculture, mining, forestry, commerce, and manufacturing Analysis of these facets reveals a partial explanation of such status.

Agriculture has long been traditional in this area. As late as 1930 the Bureau of the Census classified 48 per cent of the employed labor force as agricultural, but by 1950 only 22 per cent was so classified: during these two decades the number of agricultural workers dropped from 80,424 to 40,044, a decrease of one half. Climate is favorable to agriculture; the growing season is over 7 months, and the precipitation exceeds 50 inches, with over half during the warm season. The terrain permits much more cultivation than is now practiced. The bottomlands are little used because of flood and health hazards, but the uplands, mostly below 500 feet in altitude, are usually level to rolling, becoming hilly only near the stream valleys. Soils are predoninantly sandy to sandy clay loams, thoroughly leached and rather infertile except in the bottoms and the

Black Belt. Heavy use of commercial fertilizers has made comparable soils productive in other areas, however. Since environment seems suitable for agriculture, the reasons for its poor status and general decline must be sought in other factors.

Agricultural change in the area from 1930 to 1954 illustrates divergent trends. The number of farms decreased a quarter (from 40,827 to 30,290); this decline was greatest in the Black Belt where Marengo dropped 51 per cent, while the two Gulf Coast counties were the only ones to show an increase. By contrast, farm acreage increased 40 per cent for the area, with every county showing significant increases. Yet crop acres harvested decreased 24 per cent in the area; the only increases were in Baldwin and Mobile, with Baldwin more than doubling its harvested acreage. Everywhere pastured acreage increased, a 160 per cent gain for the area, while woodland acreage increased throughout also, for an area gain of 89 per cent.

The traditional agriculture of this area used to be cotton for cash, corn and livestock for subsitence. In Baldwin and Mobile specialty agriculture began developing over 50 years ago; now Baldwin markets over 25 different crops yearly, and sold in 1954 over $10.3 million in farm products. The next most prosperous were Mobile with $6.5 million and Covington with $5.1 million in sales. On the northern edge, as a result of the boll weevil and soil erosion, the Black Belt has changed from a cotton economy to a livestock one. In Marengo, for example, cotton acreage harvested dropped from 82,235 in 1929 to 18,935 in 1954, a 77 per cent decrease, but cattle increased from 31,567 to 65,755, an increase of 108 per cent. On the east, Wiregrass farming changed with the impact of the boll weevil. A new pattern of diversified farming developed around peanuts and hogs, corn and cattle, as well as some cotton. Such changes on the margins are leading to some changes in the core, primarily an increase in cattle and hogs but with cotton also included, though with less importance. In Clarke County, for example, during these 25 years the number of farms decreased 19 per cent but farm acreage increased 46 per cent. Crop acres harvested decreased 41 per cent but pastured acreage increased 284 per cent and woodland 104 per cent. Today two-thirds of Clarke's farmland is forested, one half pastured, and only a tenth is cropland harvested, while half of the farmers in 1954 got more income from other sources than they did from the sale of farm products.

In 1944 an alternative source of income for the area developed with the discovery of the Gilbertown oil field in Choctaw County (See Figure 1). Two other small pools have been found, the South Carlton along the Clarke-Baldwin line and the Pollard in Escambia,

but the real find came in 1955 when the Citronelle field in northern Mobile came in at depths greater than 10,000 feet. The Citronelle field more than trebled State production, which reached the 5,518,-416 barrel level in 1957.[3] While production royalties apply to only four small areas, there has been extensive leasing of oil drilling rights in the area, and the provision of some jobs.

With the exception of Mobile, commercial activities in the area are on the local supply level, since all other cities and towns are below the 10,000 population size. Although the 1950 census reported only 129,009 people in Mobile City, a legislative enactment of 1956 trebled its area, so the city now claims to have over 165,000 people. Here is the primary location for non-agricultural jobs in Southwest Alabama. The State Department of Industrial Relations reports that during the first half of 1957, 65 per cent of them were in Mobile County.[4] Of these 58,225 jobs, a third (19,510) were in manufacturing and two thirds (38,715) in non-manufacturing; these non-manufacturing jobs were 75 per cent of the ones in this class in the area. The port functions of Mobile have expanded so much that it is now the tenth U. S. port in foreign trade tonnage.[5] As a result of these port activities, Mobile is now a trade center for a large hinterland which extends even into the Middle West.

Manufacturing jobs in the area in early 1957 were reported at 37,089, with 53 per cent of them in Mobile County. Shipbuilding and ship repair, plus the many small supplier industries, normally provide a quarter of Mobile's industrial jobs. The rapidly growing chemical industry is also significant; the discovery of the McIntosh salt dome started a chemical boom in the area. (See Figure 1). Beginning in 1951 over $30,000,000 has been invested in chemical plants plus the 1953 $25,000,000 rayon mill of Courtaulds, Ltd., which has been tripled in size since then. The major industry, however, is in the wood process field; the city claims to be "the most important pulp, paper, and paper products center of the Nation," and the recently enlarged International Paper Company's establishment is the largest paper manufacturing plant in the world.

Covington is the second most important industrial county in the area, with 12.5 per cent (4,654) of the jobs, while Escambia is third with 6 per cent (2,248). The other 9 counties had from 720 jobs in Sumter to 1,961 in Clarke. Textiles and apparel are particularly important in Covington and Escambia, with one or more plants in each of the other counties.

Everywhere, however, forest-related industries are of importance. In 1954 over 330 of the 798 establishments reported by the Census were of this character, or 42 per cent of the total. While saw-

mills and planing mills constitute over two-thirds of these plants, the total also includes 19 veneer and 10 specialty mills, 3 crate and box plants, 4 pulp mills, 9 paper products plants, and 23 naval stores plants.

Since the area trend is toward increased dependence upon manufacturing for jobs and for better incomes, the status and trends in the forest base are of fundamental importance to the area. As is shown in Figure 5, 10 of the counties have over two-thirds of their acreage in commercial forest; only the two Black Belt counties of Marengo and Sumter have less.[6] The status and trends in the forest base and in the forest-related industries will be covered by other members of this symposium.

FOOTNOTES

All statistics are calculated from U.S. Bureau of the Census publications except when otherwise stated.

1. T. P. Abernethy: **The Formative Period in Alabama, 1815-1828,** 9-11, 38-39, 70-74.
2. M. H. Hawley: "Income Payments in Alabama Counties," **Alabama Business,** 26:8 (Apr. 1956)
3. Personal communication from State Oil and Gas Board, 11 Feb. '58.
4. Letter from Director, Alabama Dept. of Industrial Relations, 17 Feb. '58.
5. **Statistical Abstract of the United States,** 1957, 591.
6. Alabama Forest Products Assn.: **Forest Products Directory,** 1956 Edition, 50-51.

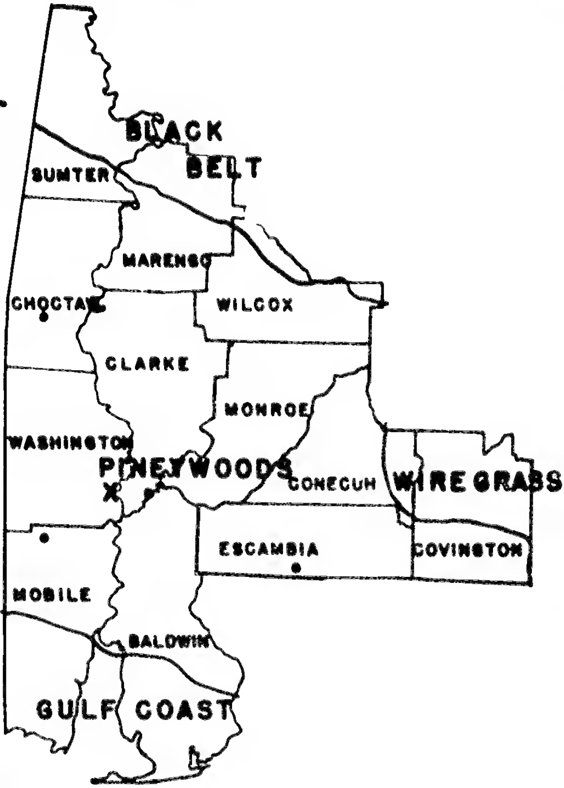


FIGURE 1 · SOUTHWEST ALABAMA

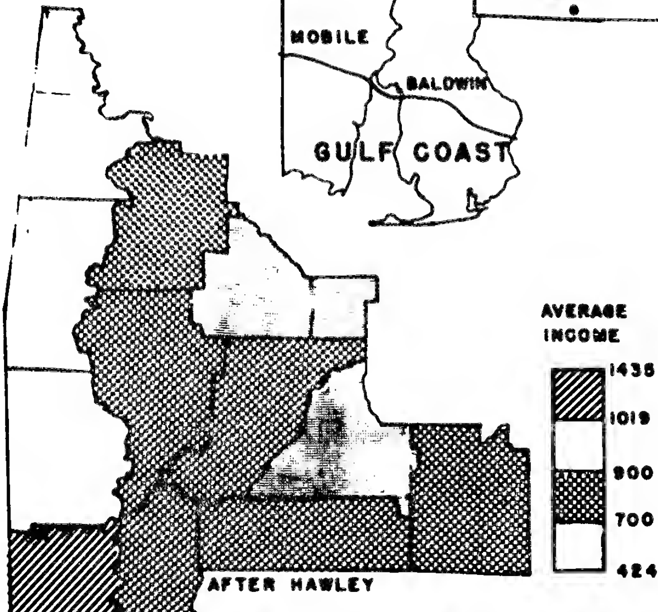


FIGURE 3 · PER CAPITA INCOME PAYMENTS TO INDIVIDUALS, 1953

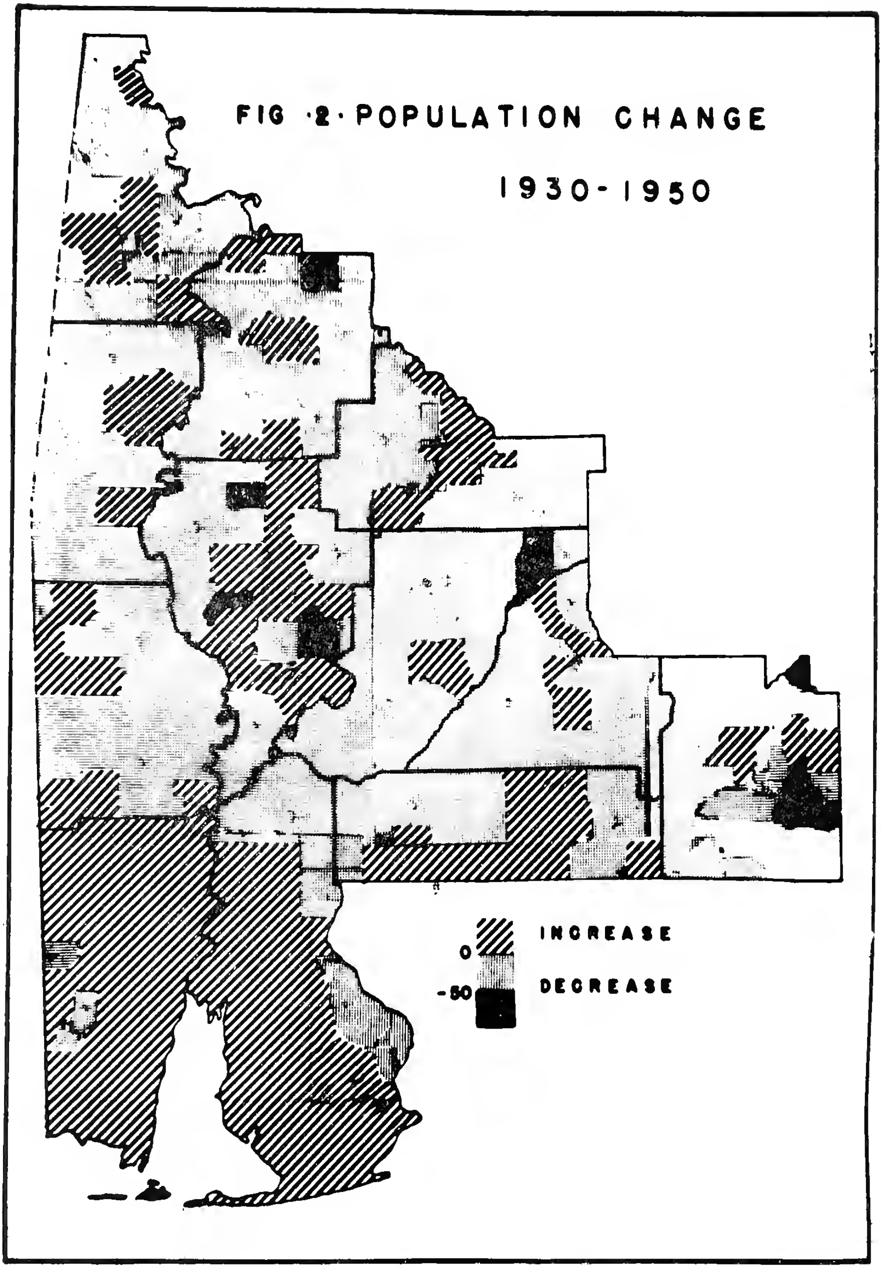


FIG ·2· POPULATION CHANGE
1930-1950
INCREASE
0
-50
DECREASE

FIGURE 4. MEDIAN SCHOOL YEARS COMPLETED: ADULTS 25 YEARS & OLDER, 1950

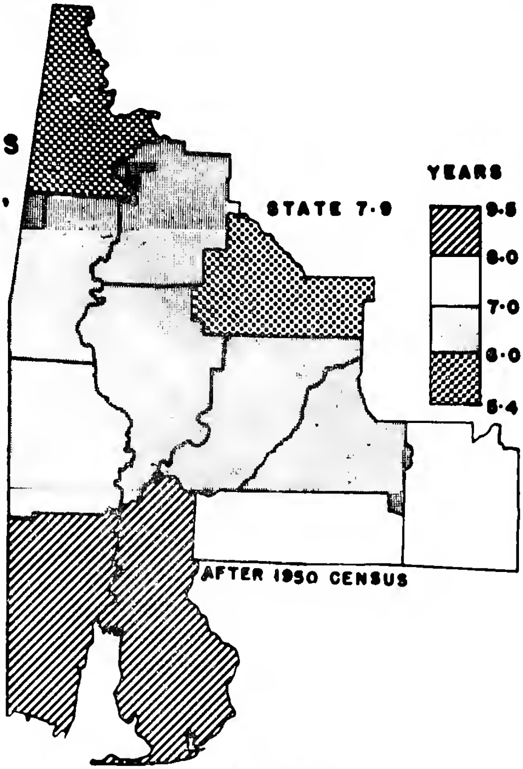
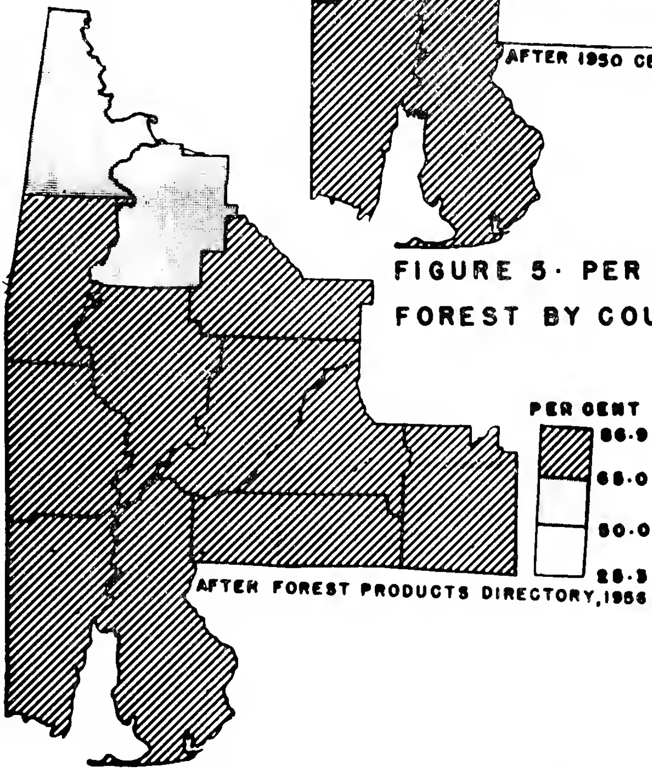


FIGURE 5. PER CENT IN FOREST BY COUNTY, 1956



THE TIMBER RESOURCE OF "THE SOUTHWEST ALABAMA FOREST EMPIRE"

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The Southwest Alabama Forest Empire comprises Survey Unit No. 1 (Southwest-South) and Survey Unit No. 2 (Southwest-North). It embraces 8,119,000 acres of land of which 6,074,800 acres are classed as commercial forest. Unproductive lands are estimated at 10,500 acres and reserved lands at 800 acres.

This major subdivision contains 24.8% of the state's total land area and 29.2% of the total commercial forest area. It has the highest proportion of forest land—74.8%, and is well above the 63.5% for the state.

In 1952 the forests of Southwest Alabama furnished 36% of the timber cut although they cover only 29.2% of the commercial forest area.

The net annual growth has reached 180 board feet per acre as compared with an average over the rest of the state of 115 board feet.

The sawtimber volume increased 29.4% between the Surveys of 1935 and 1951-1953—29.5% in pine and 29.1% in hardwoods. During this interval the total volume for the state decreased .73%—the pines decreased 13.3% while the hardwoods increased 23.4%.

If the 1951-1953 Survey data for sawtimber were adjusted to the same standards as those used in compiling the 1935 data, the increase in volume would be considerably less — 13% for total volume, 16% for pine and 7% for hardwood. These latter percentages were recently furnished by the Southern Forest Experiment Station. For purposes of this report, the data are compared directly without attempting to make adjustments between standards for the first Forest Survey and the second Forest Survey.

Total growing stock increased 26%—17% in pine and 39% in hardwoods. During the interval between Surveys, the total for the state decreased .9%—the pines decreased 18% while the hardwoods increased 19.8%.

The magnificent timber that was found in the virgin forests contributed to the rapid development and settlement of the region, the state and the nation. The timber that is presently being cut

from the second, third and fourth growth forests that now occupy the land is helping to sustain, stabilize and expand the economy of the area.

Historical. The character of the original tree growth has been described by numerous travelers and writers. Since very few remnants of the original forests remain, dependence must be placed on their observations to visualize the kind, quality and quantity of the timber at the time Alabama was being opened up for settlement.

1773-1778. William Bartram traveled extensively in Alabama from 1773 to 1778. At that time the maps available to the wayfarer left much to be desired, consequently it is rather difficult to trace his route. However, from some of the landmarks that are mentioned, it seems that he made his way down the Tallapoosa River to the vicinity of Montgomery, thence southwesterly to the Escambia River, thence to Mobile and up the Tombigbee River to what is now Clarke County. His comments on the trees that he observed growing in the "Southwest Alabama Forest Empire" are noteworthy. For instance:

> "We now entered a remarkable grove of Dogwood trees (Cornus florida) which continued nine or ten miles unalterable, except here and there a towering Magnolia grandiflora; the land on which they stand is an exact level; the surface is shallow, loose, black mould, on a stratum of stiff, yellowish clay and these trees were about twelve feet high, spreading horizontally, their limbs interweaving and interlocking with each other, formed one vast, shady, cool grove so dense and humid as to exclude the sunbeams and prevent the intrusion of almost every other vegetable, affording us a most desirable shelter from the fervid sunbeams at noonday. This admirable grove by way of eminence has acquired the name of the Dogwoods."

Approximately 20 miles south of the "Dogwoods," Bartram's party forded in the evening the Schambe (Escambia) River which empties into Pensacola Bay. Then he traveled 50 miles over a level country—"a vast flat grassy savanna and cane meadows—intercepted with narrow forests and groves, on the banks of creeks and rivulets, or hammocks and swamps at their sources with longleaved pines scatteringly planted amongst the grass."

Passing up river from Mobile 30 miles or so, Bartram observed Cypress of "astonishing magnitude." He wrote that Magnolia grandiflora (Populus magnolia) "reigns sovereign of the forests." Bartram made his way up the Tombigbee River. The locale of the following quotation is probably in the general vicinity of the southern part of Clarke County:

> "Came to a very high steep bluff of red and parti-coloured tenacious clay. On the opposite side of the river is a district of swamp or lowland, the richest I ever saw, or perhaps anywhere to be seen; as for the trees

I forbear to describe them, because it would appear incredible; let it suffice to mention that Cypress, Ash, Platanus, Populus, Liquidamber and others are by far the tallest, straightest and every way the most enormous I have ever seen."

1818-1819. During the years 1818 and 1819, a man by the name of John Landreth was employed by the U. S. Board of Navy Commissioners as a surveyor of Live Oak and Red Cedar. The wood of these two species was essential to the shipbuilding industry—particularly the construction of warships. His job was to reserve from the public domain certain sections of land on which Live Oak and Red Cedar occurred in abundance. He journeyed down to the southern part of Clarke County which then was a part of Monroe County. The following excerpts have been taken from his journal:

Visited Cedar Creek.

T.6 R.4 E, Monroe County, Sections 1, 2, 3, 4, 5, 9, 10, 11 and 12 should be reserved—5,760 acres contain Red Cedar.

T.7, R.4 E, Monroe County, Sections 32, 33, 34 and frac. Sec. 29 should be reserved—2,320 acres contain Red Cedar.

Red Cedar trees 1 to 3 feet in diameter and 40 to 50 feet in height, clear of limbs.

On the 8,080 acres, there are 80,000 tons or 3,200,000 feet of prime Red Cedar.

Yellow heart pine 3 to 6 feet in diameter and 60 to 70 feet clear of limbs. Also considerable quantity of elegant White Oak.

Although Landreth did not qualify his estimate, it is believed that he was referring to cubic feet rather than board feet and to merchantable volume in squared timbers rather than in standing trees. The term "board foot" was not in common use at the time. Instead "superficial foot" was used in describing the contents of planks and boards.

1901- . Charles H. Mohr, who wrote "Plant Life of Alabama" had this to say about the timber in the southern part of the state:

"The forests of longleaf pine of this Lower Pine region furnish principally the enormous supplies of timber used by the sawmills situated in the tide-water region of Alabama and Western Florida, with Mobile and Pensacola for the chief points of export, and they are the source of the resinous products which find their market at Mobile. The depletion of their timber wealth with no heed given to their maintenance, and their destruction by the barbarous methods practiced in the extraction of their resinous products, together with the ravages of the fires which one season after another destroy the seedlings and the youngest timber, and with the injuries inflicted by herds of domestic animals which roam through these forests, not only are exhausting their present resources but will inevitably and within a comparative short time result in their extermination, not-with-standing the fact that in no other region within the wide range of distribution of the longleaf pine are conditions more favorable for the spontaneous reproduction of this most remarkable tree."

1905. In 1905 Dr. Henry Gannett, Geographer, (among other things he wrote the forestry text contained in the Twelfth Census Report) described the timber growth in Alabama in these words:

> Alabama—the northern part of the state, including nearly three-fourths of it, is covered with a timber growth of which hardwoods form the principal component . . . The southern fourth of the state is covered with a nearly pure growth of yellow pine, mainly of the longleaf species. In the marshes around Mobile Bay, however, this gives way to cypress.

In writing of the entire southern pine region, Defebaugh in his "History of the Lumber Industry," which was published in 1906, sounded a warning when he said:

> "But as the pines cover more or less solidly so wide a range of country, and as their rate of growth is so rapid, there appears to be no reason why with conservative management they should not supply indefinitely a consumption as great as the present. However, only the beginnings of conservative lumbering have been made; in fact, the perpetuation of these wonderful resources is only beginning to be considered by the owners of forests and by lumber producers."

Defebaugh further stated:

> "All past estimates as to the amount of standing timber in the United States have been grossly inaccurate. Without exception they have been far too low, as has been demonstrated by experience."

Mr. Gannett in his report on the lumber business in connection with the twelfth census says "The average stand of timber on this area (refers to pure pine forests from the Carolinas to Arkansas) is not far from 3,000 feet board measure per acre." In this same census report, ownership in Alabama by lumbermen is shown as 1,224,835 acres with an average merchantable timber stand per acre of 4,200 board feet.

Again quoting Mr. Defebaugh:

> "The most valuable of all the southern pines, though perhaps not adapted to the most diversified uses, is the longleaf pine: the famous American pitch pine of foreign trade, or the Georgia pine of domestic commerce up to the time when the more definite term, longleaf pine, was adopted. This wood was principally confined to a belt about 125 miles in width roughly following the coast from the mouth of Chespeake Bay to the Trinity River in Texas. The distribution of this wood was continuous from the first-named point to Western Mississippi. . . ."

The growth of this wood in respect to quality and quantity per acre was remarkably uniform through South Carolina, Georgia and Alabama, but while the immense resources of Georgia and the early prominence of that State in its production and coast wise shipment gave the name "Georgia pine" to the product, the average density, if not the quality of growth, increased toward the west. Thus, the Georgia forests produced higher averages per acre than those of South Carolina, and Alabama forests were denser than those of

Georgia or northern Florida; while still heavier were the longleaf forests of Mississippi; and in Mississippi the western portion of the forests, lying west of the Pearl River, were the heaviest.

1897. In "The Timber Pines of the Southern United States," 1897, Mohr stated that as early as 1850 there was a feeling in Alabama that fires were the greatest evil to be combatted in forest conservation. He described the longleaf forests between the Alabama and Tombigbee Rivers as being unsurpassed within the range of the species. "By careful estimates made upon a number of plots, selected at rondom, the yield of a single acre will vary from 10,000 to 18,000 feet and over of merchantable timber . . . The lowalnds of the flood plain of the Alabama and Tombigbee Rivers and of their larger tributaries are heavily timbered . . . From estimates made in various districts it appears that fully 6,000 feet of merchantable timber (hardwoods) can be safely assumed as to the average yield per acre."

Quoting further from Dr. Mohr:

> "Upon these clearings, made scarcely two-thirds of a century ago, Cuban Pine has already attained the dimensions of useful timber, the trees averaging from 18 to 24 inches in diameter with a height of from 85 to 100 feet. A number of trees felled upon one of these old clearings in the suburbs of Mobile furnished sticks of merchantable timber 30 to 40 feet in length, none of them having reached an age of over 60 years."

In describing the cypress that occurred in the bottomlands along the Mobile River and the Tombigbee and Alabama Rivers, Dr. Mohr said:

> "The mighty trunks rise to a total height of from 100 to 120 feet and over, with a diameter, measured above the buttresses which expand the bases, of from 3 to over 5 feet. The annual rings of growth are extremely narrow and difficult to count. On close investigation the age of full-grown trees can be estimated to vary between 300 and 500 years."

Naval Stores. The following extracts were taken from "The Timber Pines of the Southern United States" by Dr. Charles Mohr:

The tapping of the trees for the crude turpentine and the manufacture of tar and pitch was first resorted to by the earliest settlers of North Carolina, and in later colonial times these products furnished the largest part of the exports of the colony . . . "Most of the crude turpentine was shipped to England. Later the distillation of spirits of turpentine was carried on in clumsy iron retorts in North Carolina and in northern cities. The introduction of the copper still in 1834 resulted in a largely increased yield of spirits of turpentine and the industry received a great impetus. With the new demand for spirits of turpentine in the manufacture of rubber goods, and its increased use as an illuminator, the number of stills increased great-

ly, and turpentine orcharding was rapidly extended south and west beyond its original limit. The large consumption caused such an increase in its production that the residuary product, rosin, became largely in excess of the demand, and, in consequence, much depreciated. This reduction of profits in the business caused the transfer of the stills from the leading markets to the source of the raw material, the forest. From that time, 1844, dates the great progress made in the extension of this industry. Up to that time more than half of the crude turpentine was distilled in North Carolina, but henceforth the industry spread into the States of South Carolina, Georgia, Florida, and the Gulf States to the Mississippi River."

"Bartram in the year 1777, in his wanderings along the western shore of Mobile Bay, had his attention attracted by three very large pots or kettles, each with a capacity of several hundred gallons, near the remains of an old fort or settlement, which he was informed were used for the purpose of boiling down the tar to pitch, there being vast forests of pine in the vicinity of this place." "In Carolina," this writer proceeds, "the inhabitants pursue a different method. When they are going to make pitch, they dig large holes in the ground, which they line with a thick coat of good clay into which they conduct a sufficient quantity of tar and set it on fire, suffering it to burn and evaporate for some time, in order to convert it into pitch, and when cool, put it into barrels until they have consumed all the tar and made a sufficient quantity of pitch for their purpose."

"The first statement of the production of naval stores in Alabama is that reported to the census of 1850, mentioned in that year as of a value of $17,800. In 1870 the production had increased to 8,200 casks of spirits of turpentine and 53,175 barrels of rosin, valued at $280,203. In 1873 the receipts in the market of Mobile had fully doubled, amounting to nearly 20,000 casks of spirits of turpentine and to from 75,000 to 100,000 barrels of rosin, besides 1,000 barrels of tar and pitch of a total value of $750,000. The largest production was reached in 1875, when the receipts reached a value of $1,200,000 up to the present only approximated in 1883 with 43,870 casks of spirts of turpentine and 200,025 barrels of rosin valued at $1,109,760. Since 1888 a steady decline in the receipts of these products has taken place, due to the exhaustion of the supplies near the commercial highways."

As of the year 1897 and prior to that time, the legal standard weight of the commercial package of rosin was 280 pounds gross while a cask represented 50 gallons of turpentine. According to present day standards a barrel of resin is considered to weigh 500 pounds and a barrel of turpentine to contain 50 gallons.

A barrel of crude turpentine weighs approximately 400 pounds. One hundred pounds of average crude turpentine will yield about 2½ gallons of spirits of turpentine and 70 pounds of rosin.

A crop of 10,500 boxes will yield from 29 to 46 barrels of turpentine and from 163 to 234 barrels of rosin.

The early census reports placed a value on lumber production, consequently it is possible to show the economic importance of naval stores compared to lumber production. For this purpose the following table has been prepared:

	Naval Stores		Lumber
Year	Value of Products	Year	Value of Products
1850	$ 17,800	1849	$ 1,103,481
1870	280,203	1869	1,359,083
1873	750,000	—	—
1875	1,200,000	1879	2,649,634
1883	1,109,760	1889	8,507,971

A comparison between the production of naval stores in 1883 and 1956 is rather enlightening. During the former year 43,870 casks of spirits of turpentine (50 gallons per cask) and 200,025 barrels of rosin (280 pounds per barrel) were produced. By conversion this amounted to 2,193,500 gallons of turpentine and 56,007,000 pounds of rosin.

According to the Severance Tax reports, Alabama produced 40,-134.6 barrels of crude gum (400 pounds per barrel) in 1956. On the assumption that 100 pounds of gum yields approximately 2½ gallons of turpentine and 70 pounds of rosin, the state's production for 1956 amounted to 401,346 gallons of turpentine and 11,237,688 pounds of rosin. Present day production in Alabama therefore is approximately 20 per cent of the peak production of 1875.

Quality of Virgin Timber. The following has been taken from "The Timber Pines of the Southern United States":

> The quality of the merchantable timber in conformity with mill standards in 1880 and the relation of age to growth is illustrated by five trees felled near Wallace in Escambia County. The average of the five trees follows:
>
> Diameter breast high .... 19.6"
> Total height .... 111.0 ft.
> Rings on stump 193
> Diameter below crown .... 14.5"
> Mean diameter of timber .... 17.0"
> Length of timber free of limb knots .... 51.0 ft.

(Largest tree 26" diameter, 106' tall, 216 rings, 50 feet clear)

At a lumber camp near Lumberton, in Washington County, nine timber trees were measured showing on the average a mean diameter of 17 inches, the clear sticks averaging 40 feet in length.

Upon one acre, selected at random in the untouched forests north of Springhill, Mobile County, very open and free from smaller trees or undergrowth, 16 trees were counted above 16 inches in diameter at breast high, namely:

No. of Trees	D.B.H.	Length of Timber
2	23"	40 ft.
2	20"	40 ft.
12	16" to 18"	35 ft.

Estimated yield 5,000 feet board measure.

Upon another acre plot of the same quarter section 64 trees above 12 inches in diameter at breast high were found of the following measurements:

No. of Trees	D.B.H.	Estimated Length of Timber
2	20"	40 ft.
26	17"	36 ft.
36	13"	24 ft.

Upon a third plot exceptionally heavily timbered, 45 trees were counted of the following measurements:

No. of Trees	D.B.H.	Estimated Length of Timber
5	25"	50 ft.
12	22"	50 ft.
28	16" to 18"	30 ft.

Estimated yield 15,000 feet, board measure, to the acre.

For five trees felled near Thomasville, Clarke County, the average measurements were as follows:

Diameter breast high	21.2"
Total height	106.2 ft.
Rings on stump	171
Diameter below crown	15.4"
Mean diameter of timber	18.2"
Length of timber free of limb knots	39 ft.

(Largest tree 26" diameter, 111' total height, 160 rings, 40 ft. clear)

Many of the trees of larger size were found affected by windshake in the direction of the rings of growth (wind-shake) in many instances impairing greatly the quality of the timber. The forests on these hills (Clarke County) are open, with a comparatively small number of young trees. Upon one acre selected at random, 46 trees were counted. They had the following measurements:

No. of Trees	D.B.H.	Length of Timber
4	25"	40 ft.
10	22"	36 ft.
26	18"	30 ft.
6	15"	25 ft.

On another acre 44 trees were found differing in their average dimension but slightly from the above, and indicating a yield of between 18,000 and 19,000 feet of lumber to the acre.

Modern lumbering methods have reduced woods waste by utilizing the full length of the tree. At the turn of the century the common practice was to cut only clear logs, consequently the timber estimates were based on clear length of the stem to the first limb. To illustrate the improvement in utilization the board feet volume of the 46 trees on the one-acre random sample was computed by using a Scribner Decimal C. volume table prepared in Coosa County for virgin longleaf pine based on diameter and total height. Heights for the 46 trees were assumed. The estimate came to 26,820 board feet for the acre which is about 50 per cent more than the estimate by the old standards. The following table gives the computation:

No. Trees	D.B.H.	Height	Volume per Tree	Total volume
6	15"	111'	310	1,860
26	18"	113'	500	13,000
10	22"	115'	780	7,800
4	25"	111'	1,040	4,160
			Total	26,820 bd ft.

Forest Surveys. The first reliable estimate and appraisal of Alabama's forest resource was that resulting from the first Forest Survey. Field work was commenced in the summer of 1934 and completed in the summer of 1936.

In 1945 a reconnaissance of timber resources in eight southern states, which placed an estimate on the timber volume as of January 1, 1946, was completed by the Southern Forest Experiment Station. Although the data were not considered as having the degree of accuracy attributed to the 1934-1936 survey, nevertheless, the estimates had value as indicating trends.

Beginning in 1951 a new Forest Survey was commenced in Alabama by the U. S. Forest Service operating through the Southern Forest Experiment Station. Seventeen years had elapsed since the start of the field work for the first Forest Survey. During that period Alabama had recovered from an industrial recession and had experienced an industrial expansion. Field work for the second Forest Survey was completed by April 1, 1953.

In preparing the timber volume from the field data of the 1951-

1953 Forest Survey, volume tables and standards for sawtimber were used that are considerably different from those of the 1934-1936 survey. For that reason direct comparisons between the two surveys and the 1945 reappraisal do not give a true perspective of the forestry situation. Nevertheless, they are indicative of trends. For instance the diameter of hardwood sawtimber was dropped from 13.0 to 11.0 inches.

Forest Land Area of Southwest Alabama. From the first Forest Survey of 1935 to the second Forest Survey of 1951-1953, the forest land area increased by 345,100 acres. The data are given in the following table:

	1935	1951-1953
Total Land Area	8,119,100 ac.	8,167,600 ac.
Commercial Forest Land	5,729,700 ac.	6,074,800 ac.
Reserved	—	800 ac.
Unproductive	2,300 ac.	10,500 ac.
Non Forest	2,387,100 ac.	2,081,500 ac.

Forest Land by Forest-Type Group, Southwest Alabama. During the seventeen years between surveys the area of forest types increased 5 per cent. Softwoods increased 6 per cent and bottomland hardwoods 17 per cent, while upland hardwoods decreased 14 per cent. The data are given in the following table:

		% Change
All types	6,074,800 ac.	+5
Softwoods	4,741,700 ac.	+6
Bottomland Hardwoods	865,300 ac.	+17
Upland Hardwoods	467,800 ac.	-14

Forest Land by Stand Size 1951-1953, Southwest Alabama. Of the 6,074,800 acres of forest land, 39% or 2,361,600 acres are classed as sawtimber—664,000 acres of large sawtimber and 1,697,700 acres of small sawtimber. To qualify as large sawtimber, an acre is required to have 1,500 bd. ft. or more with at least half the volume in trees 15" or larger. A minimum of 1,500 bd. ft. is the standard for small sawtimber. Softwoods 5" to 9" and hardwoods 5" to 11" are classed as pole timber. The following table gives the forest land broken down by stand size:

All stand trees	6,074,800 ac.
Large Sawtimber	664,600 ac.
Small sawtimber	1,697,700 ac.
Pole timber	2,684,100 ac.
Seedling and Sapling	879,300 ac.
Unstocked and other areas	149,100 ac.

Sawlog Growing Stock, Entire State and Southwest Alabama.

Despite an exceedingly heavy commercial drain during the seventeen years between surveys, the sawlog growing stock for the state as a whole decreased but 280,400,000 bd. ft., dropping from 38,491,000,000 bd. ft. to 38,210,600,000 bd. ft. The pine decreased while the hardwood increased. Changing the standard for a hardwood sawlog from 13 inches d.b.h. to 11 inches d.b.h. accounts in part for the hardwood increase. Had this standard remained unchanged, the decrease in sawtimber volume would have been much greater. The state data follows:

	1935	1946 (2)	1951-1953
		Board Feet	
Pine	25,304,500,000	20,472,000,000	21,928,900,000
Hardwoods	13,186,500,000 (3)	12,889,000,000 (3)	16,281,700,000 (3)
Total	38,491,000,000	33,361,000,000	38,210,600,000

The sawtimber situation in Southwest Alabama stands out in marked contrast to that of the entire state. For this area there was an appreciable increase in pine and in hardwood. The total volume increased from 12,153,500,000 bd. ft. to 15,729,600,000 bd. ft. The Southwest Alabama data follows:

	1935 (1)	1946 (2)	1951-1953 (2)
		Board Feet	
Pine	8,112,000,000	8,879,000,000	10,509,500,000
Hardwood	3,870,100,000	3,511,000,000 (3)	5,220,100,000 (3)
Cypress	171,400,000	—	—
Total	12,153,500,000	12,390,000,000	15,729,600,000

(1) Green Lumber Tally (2) International ¼" Rule (3) Includes Cypress

The Southwest Alabama region, which contains 29.2% of the commercial cypress area of the state has 47.9% of the total pine sawlog growing stock and 32% of the total hardwood sawlog growing stock, or 41.2% of all of the sawlog growing stock. The data follows:

	1951-1953 State	1951-1953 Southwest	Percent of Total
		Board Feet	
Pine	21,928,900,000	10,509,500,000	47.9%
Hardwoods	16,281,700,000	5,220,100,000	32.0%
Total	38,210,600,000	15,729,600,000	41.2%

Between surveys the pine sawlog growing stock for the entire state decreased 13.3% while the hardwood increased 23.4%. With respect to the total volume, the sawlog stock decreased .73%.

Southwest Alabama offers quite a contrast. For this region the

pine sawlog growing stock increased 29.5%, the hardwood 29.1%, while the total volume increased 29.4%. The data follows:

Change Between Surveys—State of Alabama

	1935	1951-1953	Change	Percent Change
		Board Feet		
Pine	25,304,500,000	21,928,900,000	-3,375,600,000	-13.3%
Hardwoods	13,186,500,000	16,281,700,000	+3,095,200,000	+23.4%
Total	38,491,000,000	38,210,600,000	- 280,400,000	- 73%

Change Between Surveys—Southwest Alabama

	1935	1951-1953	Change	Percent Change
		Board Feet		
Pine	8,112,000,000	10,509,500,000	+2,397,500,000	+29.5%
Hardwoods	4,041,500,000	5,220,100,000	+1,178,600,000	+29.1%
Total	12,153,500,000	15,729,600,000	+3,576,100,000	+29.4%

The first Survey reported that, for the state as a whole, 65.7% of the total volume of sawlog growing stock was pine and 34.3% hardwood. The second Survey reported that the proportion of pine and hardwood had changed substantially, pine representing 57.4% of the total volume and hardwood 42.6%.

For Southwest Alabama there was no significant change in the proportion of pine and hardwood. In 1935 pine represented 66.7% of the total volume and in 1951-1953, 66.8%. In 1935 hardwood represented 33.3% and in 19511953, 33.2%.

Total Growing Stock, Entire State and Southwest Alabama. Total growing stock is the net volume in cubic feet or cords of sawtimber and pole timber trees from stump to a minimum 4.0 inch top diameter (of central stem) inside bark.

For the state as a whole, between Surveys the pine growing stock decreased 18%, the hardwoods increased 19.7%, while the total volume decreased .9%

In contrast, for Southwest Alabama between Surveys, the pine increased 17%, the hardwood increased 39% while the total volume increased 26%. The data follows:

Total Growing Stock—State of Alabama—Cords

	1935	1951-1953	Change	Percent Change
Pine	91,449,000	74,880,000	-16,569,000	-18.12%
Hardwoods	75,959,800	90,989,000	+15,029,200	+19.79%
Total	167,408,000	165,869,000	- 1,539,800	- .92%

Total Growing Stock—Southwest Alabama—Cords

	1935	1951-1953	Change	Percent Change
Pine	28,476,600	33,366,000	+ 4,889,400	+17.17%
Hardwoods	19,919,700	27,627,000	+ 7,707,300	+38.69%
Total	48,396,300	60,993,000	+12,596,700	+26.03%

Net Annual Growth, Entire State and Southwest Alabama. In 1936, 31.92% of the net annual growth of sawtimber was in Southwest Alabama and in 1951 it was estimated at 39.59%. With respect to total growing stock 33.09% of the growth in 1936 and 34.75% in 1951 occurred in Southwest Alabama. The data are given in the tables that follow:

Net Annual Growth of Sawtimber—1956

	State	S. W. Alabama	Percent of Total
All Species	2,769,600,000 bd. ft.	1,096,500,000 bd. ft.	39.59%
Pine	1,863,700,000 bd. ft.	813,900,000 bd. ft.	43.67%
Hardwoods	905,900,000 bd. ft.	282,600,000 bd. ft.	31.20%

Net Annual Growth of Sawtimber—1951

	State	S. W. Alabama	Percent of Total
All Species	2,769,600,000 bd. ft.	1,096,500,000 bd. ft.	39.59%
Pine	1,863,700,000 bd. ft.	813,900,000 bd. ft.	43.67%
Hardwoods	905,,900,000 bd. ft	282,600,000 bd. ft.	31.20%

Net Annual Growth of All Growing Stock—1936

	State	S. W. Alabama	Percent of Total
All Species	560,090,000 cu. ft.	185,320,000 cu. ft.	33.09%
Pine	353,130,000 cu. ft.	125,040,000 cu. ft.	35.41%
Hardwoods	206,960,000 cu. ft.	60,280,000 cu. ft.	29.13%

Net Annual Growth of All Growing Stock—1951

	State	S W. Alabama	Percent of Total
All Species	768,600,000 cu. ft.	267,100,000 cu. ft.	34.75%
Pine	420,600,000 cu. ft.	168,300,000 cu. ft.	39.08%
Hardwoods	338,000,000 cu. ft.	98,800,000 cu. ft.	29.23%

Commodity Drain, Entire State and Southwest Alabama. According to the Forest Survey, this term is defined as the volume of material removed from commercial forest land during a specified year as timber products or logging waste.

In 1936, 32.75% of the commodity drain on sawtimber was in Southwest Alabama. In 1951, it was 34.86%. With regard to all

growing stock, 31.56% occurred in Southwest Alabama in 1936 and 34.89% in 1951.

Comparison Between Growth and Drain

Saw Timber 1936-1951. In 1936 for the entire State the commodity drain in sawtimber was 182,900,000 board feet in excess of growth In 1951 growth exceeded drain by 259,500,000 board feet.

In 1936 for Southwest Alabama, the commodity drain in sawtimber exceeded growth by 76,900,000 board feet. In 1951 growth exceeded drain by 221,400,000 board feet.

In 1936, 42% of the deficit was in Southwest Alabama but in 1951, 85% of the excess growth occurred in this region.

All Growing Stock 1936-1951. In 1936 for the entire state growth exceeded commodity drain by 44,140,000 cubic feet. In 1951 growth exceeded drain by 173,300,000 cubic feet.

In 1936 for Southwest Alabama growth exceeded drain by 22,510,000 cubic feet. In 1951 growth exceeded drain by 59,400,000 cubic feet.

In 1936, 51% of the excess growth over drain was in Southwest Alabama. In 1951, 34% of the excess growth occurred in this region.

Production of Forest Products, Entire State and Southwest Alabama 1952-1956. A severance tax is paid by the manufacturer and/or producer of forest products. From taxes paid, the Division and Forestry prepares a report showing the quantities of products cut each calendar year by counties. For the five year period 1952-1956 inclusive, 36.5% of the pine lumber, 29.4% of the hardwood lumber, 39.1% of the pulpwood, 93.9% of the stumpwood, 97.9% of the naval stores and 88.6% of the poles and piles were produced in Southwest Alabama. The complete data follows:

		Production 1952-1956 (inclusive		Percent of
Product	**Unit**	**Entire State**	**S. West Ala.**	**Total**
Pine Lumber	Ft. B. M.	5,408,554,000	1,973,819,000	36.5%
Hardwood Lumber	Ft. B. M.	2,790,426,500	820,849,600	29.4%
Pulpwood	Standard Cords	9,342,130	3,654,201	39.1%
Cross Ties	Pieces	7,158,640	1,909,219	26.6%
Mine Ties	Pieces	830,550	10,870	1.3%
Mine Props	Pieces	9,514,710	1,284,680	13.5%
Crde. T'pentine	400 lbs. Bbls.	203,931	199,825	97.9%
Stumpwood	Tons	1,499,655	1,408,659	93.9%
Poles & Piling	Pieces	2,755,981	2,441,796	88.6%

Summary. The "Southwest Alabama Forest Empire" is a natural timber growing region. Although it contains 29.2% of the commercial forest area of the state, it produces approximately 36% of the

pine lumber, 29% of the hardwood lumber, 39% of the pulpwood, 98% of the crude turpentine, 94% of the stumpwood and 87% of the poles and piles.

According to the second Forest Survey, 48% of the pine and 32% of the hardwood sawtimber is in this region. Of the total sawtimber, volume, pine and hardwoods, 41% is in Southwest Alabama.

The average acre in the Southwest-North Unit (Survey Unit No. 2) has a stand of 3,042 board feet per acre and in the Southwest-South Unit (Survey Unit No. 1) 2,100 board feet. This compares to the state average for all types of 1,841 board feet.

With respect to net annual growth, 39.59% of the sawtimber growth and 34.75% of all growing stock growth occurs in Southwest Alabama.

The full timber growing potential of Southwest Alabama has not yet been reached. Considerable progress has been made in protecting and managing the timber crop during the 17 years between Forest Surveys. This is clearly reflected by the comparative data.

Moisture is generally conceded to be the limiting factor of tree growth. The forester, subject to certain economic restrictions, can control the type of vegetative cover that utilizes the moisture in the soil. Until he can eliminate scrub trees, inferior or off-site species, and substantially reduce grass, weeds and shrubs, he need not expect to grow the maximum amount of wood which the site is capable of producing.

The diversity and accessibility of markets for wood products that characterize Southwest Alabama has probably stimulated timber growing to a greater degree in this area than any other section of Alabama. It is expected that these factors will exercise a continuing influence on the timber growing enterprise.

ACKNOWLEDGEMENT. The information and subject matter comprising this dissertation has been obtained from many sources. In some instances the materials has been quoted direct and in others indirect. No claim to originality is made as it is quite possible that a few direct quotes are not shown as such. The following sources were drawn on quite freely:

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THE PULP AND PAPER INDUSTRY IN THE SOUTHWEST ALABAMA FOREST EMPIRE

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The Southwest Alabama forest empire includes the twelve counties in the Southwest corner of the state, and in this area is centered the state's pulp and paper industry. Of the seven primary pulp and paper mills operating in Alabama, five are located in this area and another mill is now under construction. In addition, there are two other pulpwood-using plants in the area manufacturing roofing and insulation material. The pulp and paper industry has contributed much to Southwest Alabama in many ways and, of course, the resources of the area make possible the operation of this important part of our state's economy.

My colleagues on the program have presented an excellent background for this discussion—because the geography of the region and its timber resources are of prime importance in the location of the pulp and paper industry here. I would like to tell you something about the development of the pulp and paper industry in this area, its present operations and its contributions to the field of forestry.

Southwest Alabama might well lay claim to having had the first paper mill in the South. Although most historical discussions on the

development of this industry in the South refer to the paper mill established in 1864 at Marietta, Georgia, as being the first in the region, there are indications that a mill at Mobile preceded that one by some eight years. Mr. J. Finley McRae, in a publication of his address given before the Newcomen Society Meeting in Mobile in 1956, mentions court records of 1856 referring to a paper mill on Three-Mile Creek, near Mobile. Mr. McRae states "This mill might well be, in some way, the predecessor of the Gulf Paper Mill Company plant built about 1917 on Three-Mile Creek, generally recognized to be the first paper mill in the State of Alabama." Even though Texas claims the birth of the southern pulp and paper industry to have occurred with the development of the mill at Orange, Texas, in 1909, Alabama can point with pride to this early paper mill at Mobile!

The Gulf Paper Mill Company plant at Three-Mile Creek, after its establishment about 1917, operated periodically. It is presently owned and operated by the Stone Container Corporation. The first permanent mill or continuous operation in the state was established by the Gulf States Paper Corporation at Tuscaloosa in 1927.

International Paper Company's mill at Mobile is the oldest continuous operation in Southwest Alabama. This mill was built in 1929 and it has been expanded and modernized continually ever since. An approximate 50 million dollar expansion program has just recently been completed, making this mill the largest in the world devoted exclusively to the manufacture of paper.

The third of the 5 mills in this area is the Hollingsworth & Whitney Division of Scott Paper Company. The mill was built in 1940 by the Hollingsworth & Whitney Company which later merged into the Scott Paper Company. A recent expansion program has also considerably enlarged the productive capacity of this mill.

The tremendous post war expansion of the pulp and paper industry in the South has included three more pulp and paper mills in Southwest Alabama—two of which have just recently begun operations, and another presently under construction. Gulf States Paper Corporation built its second Alabama mill at Demopolis in 1957, and Container Corporation of America selected Brewton as the site for its newest mill which began operation at the beginning of this year. The Marathon Corporation, now a part of the American Can Company, is currently building a mill at Naheola in Choctaw County. Additional mills, such as St. Regis at Cantonment, Fla., and International's mill at Moss Point, Miss., are located just outside of the area, but do procure pulpwood from these counties. The

Southwest Alabama forest empire has truly attracted a great pulp and paper industry.

In the aggregate, the pulp and paper mills currently in operation in this area have a daily capacity of 2,225 tons, use about 1,280,000 cords of pulpwood each year (excluding Stone Container which uses waste paper as raw material), and employ thousands of people. In addition, many more people are employed in the woodlands areas which provide the basic raw material for these mills. Many small communities now depend upon timber management and the cutting and hauling of pulpwood and other forest products as their basic source of income.

One of the prime reasons for the location of the pulp and paper mills in this area is the available forest resource. The United States Forest Service, in a report on its forest survey in Alabama, states that Southwest Alabama has the highest proportion of forest land in the state—75%. A significant fact brought out in this report is that approximately 63% of Alabama's forest land can be considered well stocked—that is, it has at least 70% of the number of good trees (including well-established seedlings) required to occupy the site for best growth, and Southwest Alabama has the best stocking.

This leads up to what I think is the chief contribution the pulp and paper industry has made in the field of forestry. By providing a market for trees which formerly were not able to be removed from a stand economically, the industry has actually made possible the practice of scientific forestry. Improvement cuttings in older stands and thinnings in young stands must be made periodically to obtain maximum timber growth. Prior to the coming of the pulp and paper industry to the South, such cuttings could not be made—except as an expense to the landowner. The industry not only provided a market for trees from such cuttings, but the landowner could now remove these trees at a profit, and at the same time improve his stand of timber.

Quoting the above-mentioned U. S. Forest Service Release " . . . the prime factor in the softwood increase is that on much of the forest acreage, timber stands are being improved by good cutting practice, by hardwood control in the uplands and by intensified fire protection." These good forestry practices are the basis of the pulp and paper companies' timberlands operations. The pulp and paper mills are permanent installations and the companies have recognized their responsibility to the forest resource.

With huge investments in the mills, the companies must have a certain amount of forest land owned in fee or under long term management contracts to back up this investment. Of Alabama's com-

mercial forest acreage of some 20,750,000 acres, the entire pulp and paper industry in the state owns slightly over 7.5%. The largest forest landowner by class in Alabama is the farmer and private landowner, who owns eight out of every 10 acres, or 80%. The mills will always be dependent upon the farmer and other private landowners for the bulk of their supply of pulpwood.

The pulp and paper industry having permanent installations has recognized in many ways its responsibility in the ownership of forest lands. First, of course, is the management of these lands in the most advanced methods of scientific forest management to produce the maximum volume of forest products, in the shortest time, and at the least cost. To do this job, the industry employs many graduate foresters. An illustration of the intent with which our industry works at this job is the fact that International Paper Company alone has over 300 graduate foresters working in its Southern Woodlands Department. Not only are we growing pulpwood on our lands, but also poles and piling, sawlogs and veneer bolts and many other products. These trees which are sold to local businessmen, provide jobs for local people and support many local wood-using industries.

That the pulp and paper industry in the South is doing a good job, is evidenced by the productivity rating given by the U. S. Forest Service. According to this agency, 81% of all industry lands in the South are now being cut so as to leave them in a high state of productivity. In the case of the pulp and paper industry, 96% of its lands are being cut so as to keep them highly productive. That's getting very close to doing a perfect job, and we in the paper industry are proud of it. Unfortunately, the rating of lands owned by farmers and other small landowners is poor. In fact, only 34% of the private non-industrial holdings in the South were rated as obtaining maximum use of their forest lands.

For Alabama as a whole, the forest survey indicates a net growth of three-quarters of a million cord over drain. For the Southwest Forest Empire this represents an approximate 25% upward change in the growing stock over the 1935 survey. By improving timber cutting practices, reducing fire losses, and planting pine seedlings on cut over timber land and abandoned farm land, we will be able to maintain a favorable balance of growth over use even with increased consumption. The pulp and paper industry's increased use of hardwoods should also materially help to improve the forest resource.

Since the pulp and paper industry is dependent on the farmer and other private landowner for approximately 80% of its supply

of pulpwood, the industry has recognized its responsibility to help these landowners grow the maximum amount of forest products on their lands. Through the industry sponsored programs such as the Tree Farm program, nationally coordinated by the American Forest Products Industries, and the educational programs carried out by member mills of the Southern Pulpwood Conservation Association, we are showing these landowners that trees can be grown much like other farm crops—that is, regular periodic harvests of a variety of products. Good forest practices pay good profits. And I might add that forest products are the one farm crop of which there are no acreage limitations, no crop surpluses, and there is a year round market.

These programs are carried out in a variety of ways from direct assistance to the landowner in the form of free pine seedlings, a timber marking service, etc., to broad educational programs, such as fair displays, talks to civic clubs, etc. The school children, who are the landowners of the future, also play an important part in these programs. Classroom lectures and movies, field trips, comic books, a summer forestry camp, etc., comprise some of the activities our conservation foresters carry out with FFA, 4-H and Boy Scout groups. One measure of the success of the pulp and paper forestry educational activities for landowners is the success of the Tree Farm program. Incidentally, the first certified member of the American Tree Farm System is Mr. E. N. McCall of Dixonville, Alabama, in Escambia County. Mr. McCall is still actively interested in tree farming, despite his 79 years. Alabama currently has 851 certified tree farms—third in the nation—representing a total of 3,832,694 acres. A tree farm is defined as an area of privately owned, tax-paying forest land dedicated by its owner to the growing and harvesting of repeated forest crops.

In addition to the forestry activities recognized by the pulp and paper industry in the management of its forest land and its program to help landowners, I would like to briefly mention the recreational aspect. While I don't have the figures for Southwest Alabama, a recent SPCA survey for the entire state indicates that 87% of the lands owned by the pulp and paper industry in Alabama are open to hunting and fishing, with another 2% under contract to the State Fish and Game Commission as game refuges. Roadside picnicking facilities are also being developed.

I would also like to briefly mention the forest research activities, being carried out by our industry. These include not only experimental projects in direct forestry activities such as tree genetics, new planting procedures and forest management studies, but in re-

lated fields such as game management. International Paper has a forester on its Woodlands staff who has a masters degree in wildlife management, plus the experience necessary to develop studies on game management consistent with maximum timber growth. Gulf States Paper Corporation also has a man so qualified on its forestry staff. Such projects as the industry's work in tree genetics give promise of a consistently greater use of our forest resource.

In closing I would like to say that the forest resource of the Southwest Forest Empire has attracted a great pulp and paper industry. Through the wise use of this forest resource an even greater development can be expected in the future with both an improved forest resource and a greater economic contribution.

CLEARCUTTING SOUTHERN PINE IN ALTERNATE STRIPS COMBINATION WITH SHELTERWOOD

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Because they consider even-aged management efficient and economical, many landowners in the southern pine region operate under this policy (5). Stand regeneration after harvest may be accomplished by planting. More often, however, the new stand is established through natural seeding. Among the classical methods of naturally regenerating an even-aged stand is that of clearcutting in alternate strips (2). The method affords most of the practical advantages of any area clearcutting, perhaps reduced to some extent by the physical restrictions caused by narrow strips. A few years after the first cut, when reproduction has become established on the clearcut strips, timber is removed from the intervening strips. Stand regeneration on the intervening strips might be by planting, by timing the second cut to coincide with ripening of an adequate seed crop, or by some variation of the shelterwood method.

In 1941, personnel[1] of the Agricultural Experiment Station of the Alabama Polytechnic Institute established a small-scale test of clearcutting in alternate strips, in combination with shelterwood on adjacent strips, for re-establishing an even-aged stand of pine. A mature, fully stocked stand would probably represent ideal conditions for such a test; but no such stand was available. The best available was an old field stand of mixed loblolly pine-shortleaf pine about 40 years old and grossly understocked.

It was on the Forest Unit in Barbour County, near Clayton, in the rolling clay hills of the Coastal Plain south of the Black Belt. Elevation was between 500 and 600 feet; topographic position was a gentle, upper, west slope (almost a flat ridge). The soil was mostly Ruston sandy loam that had suffered moderate to severe sheet erosion, with an occasional shallow gully. Wild fires had swept the area almost annually prior to acquisition of the forest by the Experiment Station in 1940.

The stand was not inventoried when the test was established. It was observed that the trees were of poor quality because of limbiness, a condition to be expected under conditions of low stocking. There was only scattered advance pine reproduction and hardly any hardwood understory, undoubtedly because of frequent fires. Harvesting such a stand to replace it with a well-stocked young stand is in line with good forest practice.

The test area was 6 chains wide by 7½ chains long, with the long axis east and west; and it was divided into 3 strips, each 2 chains in width. The area was bounded on the north by a fire lane, in turn bordered partly by open field and partly by very scattered timber. On the south were open field and badly gullied woodland, cleared for a distance of 2 chains to give the effect of a continuing series of clearcut strips when the test was established. All timber was removed from the center strip, designated clearcut strip, in March 1941. Records are not clear as to whether the north and south strips, designated shelterwood strips, were partially cut in 1941 or it was intended to make the shelterwood cut a few years later. In either event, the combination of low degree of stocking and open edges of the narrow strips resulted in a stand that was the equivalent of a shelterwood after seed cutting (2). Within the year, considerable, though spotty, establishment of pine reproduction was observed on all strips, and the stand on the shelterwood strips was not further reduced until the removal cutting.

The first detailed stand measurements were made in February 1949, 8 years after the strip clearcutting. (Table 1.) Age of the trees in the shelterwood was established at 45 to 50 years by increment borings. Average height of dominant loblolly pines was 61 feet; of dominant shortleaf pines, 49 feet. Existing site index curves are not applicable to an understocked, frequently burned stand such as this (4). A complete inventory of trees 3.6 inches d.b.h. and larger on each strip was made. A representative sample of trees less than 4½ feet tall (seedlings) and trees 4½ feet or more tall but less than 3.6 inches d.b.h. (saplings) was tallied on 5-mil-acre circular plots, 16 on the clearcut strip and 8 on each shelterwood strip.

TABLE 1. Stand and stock per acre, eight years after clearcutting in alternate strips and before removal of shelterwood from intervening strips, second growth loblolly pine-shortleaf pine

Species or group	Trees less than 3.6 inches d.b.h., and-		Trees 3.6 inches d.b.h. or larger				Trees 7.6 inches d.b.h. or larger	
	Less than 4½ feet tall (seedlings)	4½ or more feet tall (saplings)	Tally	Basal area	Total stewood volume1/	Pulpwood volume2/	Tally	Sawtimber volume3/
	Number	Number	Number	Sq. ft.	Cu. ft.	Cords	Number	Bd. ft.
CLEARCUT STRIP								
Loblolly p.	2,550	',400	86	10.5	1002	1.0	0	0
Shortleaf p.	500	100	14	1.8	18	.3	0	0
All pines4/	3,050	1,500	100	12.3	120	1.3	0	0
Hardwoods	5/	5/	2	.2	1	.0	0	0
SHELTERWOOD STRIPS								
Loblolly p.	3,710	2,430	54	40.0	866	6.5	33	5,330
Shortleaf p.	1,280	160	30	9.6	105	1.7	8	680
All pines4/	4,990	2,590	85	50.2	984	8.3	42	6,080
Hardwoods	5/	5/	3	.8	13	.1	1	20

1/ Peeled wood, to 2-inch top (4)
2/ Rough wood, to 3-inch top inside bark (4)
3/ International ¼-inch kerf rule, tree scale.
4/ Discrepancies in totals are due to a few longleaf pines.
5/ None encountered on sample plots.

The removal cutting on the shelterwood strips immediately followed the 1949 measurements. Only pine sawtimber was cut. One shortleaf and two loblolly pines per acre in the 10 to 12 inch diameter class were left as insurance seed-trees, to re-seed the area in case the young stand should be destroyed by fire.

A re-inventory of the test area was made in June 1954, 13 years after strip clearcutting and 5 years after removal cutting on the shelterwood strips. (Table 2.) Again, all trees 3.6 inches d.b.h. and larger were measured, and reproduction was sampled. Size of reproduction plots was reduced to 2 mil-acres, and their number was increased to 32 on each of the three strips.

At the 1949 examination, 8 years after the strip clearcutting and before removal cutting on the shelterwood strips (Table 1), there was sufficient reproduction to restock the entire area. The reproduction count showed about 3,000 pine seedlings and 1,500 pine saplings per acre on the clearcut strip, 5,000 seedlings and 2,600 saplings per acre on the shelterwood strips, 97 per cent of the 5-mil-acre sample plots stocked with seedlings, and 78 per cent stocked with saplings. The only sample plot on which no reproduction occurred was in the clearcut strip. Loblolly pine was the predominant species. The proportion of shortleaf pine was higher under the shelterwood than on the clearcut strip, perhaps indicative of a higher degree of intolerance of loblolly. On the clearcut strip, 100 pines per acre, with a basal area of 12 square feet and a pulpwood scale of 1.3 cords, had reached 3.6 inches d.b.h. The shelterwood consisted of 85 pines per acre with a basal area of 50 square feet and a pulpwood scale of 8.3 cords. Of these, 42 were 7.6 inches d.b.h. or larger and scaled a little over 6,000 board feet.[2] The hardwood component of the reproduction stand was practically negligible.

Five years after removal cutting, there were fewer seedlings and saplings, but the numbers were still more than sufficient to restock the area. The count showed about 1,700 pine seedlings and 1,750 saplings per acre on the clearcut strip, 2,800 seedlings and 1,700 saplings per acre on the shelterwood strips. Reduction in numbers of trees in the reproduction classes can be attributed to a combination of natural mortality, growth into larger size class, and logging damage. On the clearcut, 398 trees per acre, with a basal area of 44 square feet and a pulpwood scale of 4.6 cords, had reached 3.6 inches d.b.h. or larger. Three trees per acre had reached minimum sawtimber size. On the shelterwood strips there were 113 pines 3.6 inches d.b.h. or larger, with a basal area of 21 square feet and a pulpwood scale of 3.3 cords. Including the three insurance seed trees, there were 410 board feet of sawtimber in 15 trees per acre.

Table 2. Stand and stock per acre, 13 years after clearcutting in alternate strips and 5 years after removal of shelterwood from intervening strips, second growth loblolly pine-shortleaf pine.

Species or group	Trees less than 3.6 inches d.b.h., and-		Trees 3.6 inches d.b.h. or larger				Trees 7.6 inches d.b.h. or larger	
	Less than 4½ feet tall (seedlings)	4½ or more feet tall (saplings)	Tally	area Basal	Total stewood volume[1]/	Pulpwood volume[2]/	Tally	Sawtimber volume[3]/
	Number	Number	Number	Sq. ft.	Cu. ft.	Cords	Number	Bd. ft.
CLEARCUT STRIP								
Loblolly p.	2,580	1,550	279	32.6	303	2.9	3	30
Shortleaf p.	260	200	119	11.4	104	1.7	0	0
All pines[4]/	2,840	1,750	398	44.0	407	4.6	3	30
Hardwoods	5/	5/	2	.4	4	.1	0	0
SHELTERWOOD STRIPS								
Loblolly p.	1,700	1,430	43	8.7	116	1.2	8	210
Shortleaf p.	60	250	69	11.8	145	2.0	6	170
All pines[4]/	1,640	1,680	113	20.8	269	3.3	15	410
Hardwoods	5/	5/	5	1.1	14	.2	1	30

1/ Peeled wood, to 2-inch top (4)
2/ Rough wood, to 3-inch top inside bark (4)
3/ International ¼-inch kerf rule, tree scale.
4/ Discrepancies in totals are due to a few longleaf pines.
5/ None encountered on sample plots.

Only two per cent of the 2-mil-acre sample plots on the clearcut were without trees; only 9 per cent of those on the shelterwood strips were unstocked.

The hardwood component remained neglible on the clearcut. On the shelterwood strips, where only pine sawtimber had been cut, hardwoods made up 5 per cent of the total basal area. A single 13-inch blackgum accounted for a large portion of this, and only 0.2 square feet per acre basal area resulted from ingrowth of hardwood reproduction.

By all appearances, this trial of clearcutting in alternate strips in combination with shelterwood on intervening strips to regenerate a stand of mixed loblolly pine-shortleaf pine was a success. Thirteen years after clearcutting and 5 years after removal of the shelterwood, all strips were abundantly stocked with thrifty, well distributed pine reproduction. The desirable pines almost completely dominated the area, and hardwood encroachment remained practically negligible. It must be recognized, however, that successful regeneration cannot with complete assurance be attributed to the manner of cutting. In view of the absence of a hardwood problem, it is entirely possible that the institution of fire protection would have been sufficient in itself to achieve establishment of reproduction. However, there is little possibility that much of the reproduction, once established, would have thrived and grown into larger classes without removal of the overstory.

Caution is necessary in applying results to different conditions. However, the possibility of regenerating a well-stocked, mature pine stand by establishing alternate, narrow, clearcut and shelterwood strips seems worth considering. Even if there are no silvicultural advantages over alternative methods, awareness of this method allows a manager an added element of flexibility in his planning. If a preparatory cut is needed to stimulate seed production, it may be confined to the shelterwood strips. Skid trails can be concentrated in the clearcut strips to minimize damage to trees that are eventually to furnish seed to regenerate the stand. The clearcutting and seed cutting on adjacent strips would be done at the same time, giving a larger and more easily operable cut than seed cutting in a straight shelterwood. For genetic reasons, only the best trees should be left as shelterwood; therefore, the removal cut should also be operable. There is no reason for the removal cut to coincide with a good seed crop. This leaves considerable latitude for choice of the time of conducting the removal cut.

In a pine stand with a hardwood understory of consequence, effective control of the hardwoods undoubtedly would be necessary

for successful regeneration. That is true no matter what the method. Nevertheless, in southern pine management the method of clear-cutting in alternate strips in combination with shelterwood should probably be confined to upland sites on which hardwoods are not vigorous invaders. On sites more favorable to growth of hardwoods, the restraining influence of the shelterwood on pine reproduction might allow the more tolerant hardwoods to gain an insurmountable lead.

FOOTNOTES

1. W. R. Boggess and P. A. Swarthout.
2. International ¼ inch kerf rule.

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WILDLIFE RESOURCES IN THE SOUTHWEST ALABAMA FOREST EMPIRE

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The southwest Alabama forest empire as considered in this paper is made up of the following counties: Baldwin, Choctaw, Clarke, Conecuh, Covington, Escambia, Marengo, Mobile, Monroe, Sumter, Washington, and Wilcox. According to the forest survey of December, 1953, over 6 million of the 8 million acres of land area in these counties are in commercial forests. Of a necessity the principal wildlife resources in the area is made up of species which prefer woodland habitat.

Wildlife is a product of the land, and the way we manage our lands has a major bearing on the size and quality of our wildlife crop — proper land use necessarily results in good basic

wildlife management. Fortunately, agriculture, forestry and wildlife, when properly managed, are reasonably compatible on the same lands.

The flat to rolling terrain of the area, composed principally of lower coastal plains soil is forestered with hardwoods along the bottomlands of rivers and smaller streams; while pines mixed with hardwoods in varying numbers are found on the uplands.

Although pure pine stands for all practical purposes are wildlife deserts, such stands, when interspersed with sufficient hardwoods, make ideal wildlife habitat. Fortunately most upland forest areas in southwest Alabama contain sufficient mast producing hardwoods to produce and maintain high populations of forest game.

This area has long been recognized as the forest game empire of the state. In the early 1900's, when such species of wildlife as the deer and turkey had been all but eliminated in most sections of the state, huntable populations were still present in most counties of this area.

In evaluating the wildlife resources, it is impossible to count each individual of a species. Wildlife moves from one area to another and prefers the more secluded areas which are away from human observation. Wildlife populations used in this paper are the results of estimates based on observation and studies made in the field by Conservation Officers of the area and by technically trained biologists.

After an estimate of the wildlife population has been determined it is impossible to place a dollar and cent value on this resource. To some individuals the recreational value of observing our wildlife is of major importance. To others the recreational value received from hunting is paramount. To some the monies received for hunting rights is the major goal while the food obtained from wildlife is of prime interest to still others.

Wildlife of any area affects the economy of that area. Direct effects are the monies spent for hunting rights, habitat improvement, guides, shells, licenses, guns, and other hunting equipment. Indirect results include monies spent for food and lodging, gasoline while on a hunting trip, and dog maintenance during the entire year.

For these reasons I shall not try to place a monetary value on our wildlife resources in the southwest forest empire. Instead I shall briefly discuss the major forest game species found in southwest Alabama and compare populations of the area with the remainder of the State.

DEER

The Alabama Department of Conservation game inventory made

in 1940 showed that Alabama had an estimated 14,000 deer. Twelve thousand and fifty of this number were in the 12 counties of southwest Alabama.

Since 1940 improved deer habitat resulting from increased land acreage in commercial forests, increased deer browse following timber operations, increased deer management on State and private hunting preserves, increased human interest in the deer populations, better protection and restocking have been factors responsible for increasing the State deer herd to 83,600 in 1957. Sixty thousand and fifty of this number were in southwest Alabama. Kill figures during 1957 indicated that 8,344 of the 10,324 deer killed in Alabama were taken in the 12 counties of southwest Alabama.

Located in Clarke County, Alabama, the Department of Conservation maintains two sanctuaries where deer and turkeys are live-trapped and used to restock depleted areas. Since 1945 approximately 825 deer have been used to stock areas in 24 counties outside of southwest Alabama and two areas in southwest Alabama.

This restocking program of southwest Alabama deer has been in part responsible for increasing the deer population throughout the State.

TURKEY

The 1940 game inventory placed 10,325 of the 13,000 turkeys present in the State in the 12 counties of southwest Alabama. Today 37,750 of the estimated 50,963 turkeys in Alabama are to be found in these same 12 counties.

The turkey, like the deer, benefited from increased land acreage in commercial forests, wise timber practices, wise turkey management on private and State managed lands, increased human interest in the populations, better protection, and restocking.

Approximately 400 wild-trapped turkeys have been removed from our two sanctuaries in Clarke County and placed on 15 different areas in 15 different counties outside southwest Alabama.

It is felt that by restocking other areas with deer and turkeys we can relieve the hunting pressure of southwest Alabama by providing hunting of these species near the hunter's home.

In the spring and fall season of 1957, thirty-seven hundred and fifty-one of the 5,205 turkeys reported killed in the State were taken in southwest Alabama.

BEAR

The river-bottom lands of southwest Alabama is the last stronghold of the Black Bear. Of the estimated 262 bears in Alabama in

October, 1957, two hundred and forty-two were located in the southwest area.

SQUIRRELS AND RABBITS

There is no way to accurately estimate the squirrel and rabbit populations on a large area. It is well known, however, that the branch heads and river bottoms of southwest Alabama maintain the largest population of grey squirrels found anywhere in the State. The red or fox squirrel is abundant in the long-leaf and slash pine stands of the area. These species provide an abundance of sport and food to hunters of the area and to hunters of other sections of the State who flock to this area for the harvest.

Rabbits are abundant in southwest Alabama, but they are not hunted in this area as they are in some other areas of the State.

FURBEARERS

Beavers, muskrats, otters, mink, raccoons, and opossums are to be found in large numbers throughout the area. Due to the lack of a market for furs, very few people engage in trapping operations. The hunting of raccoons and opossums with dogs is still a major sport in southwest Alabama.

WATERFOWL

In years of good acorn crops wood ducks and mallards appear in large numbers and provide excellent hunting in the sloughs, lakes, and beaver ponds in southwest Alabama. The marsh and bay shooting on the Mobile Delta area needs no comment.

QUAIL AND DOVE

Although quail and doves prefer the more open agricultural areas, certain sections of southwest Alabama are ideal for these game birds. These species are often found in large numbers in the wooded areas near field borders although they are not considered forest birds.

CONCLUSION

The forest empire of southwest Alabama is rich in wildlife resources. This area produces more deer, turkeys, squirrels, and furbearers than any other section of the State. Hunting is excellent and prospects for the future are bright.

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THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

(Affiliated with A.A.A.S.)

OFFICE OF THE EDITOR
ALABAMA COLLEGE
MONTEVALLO, ALABAMA

VOLUME 30 APRIL, 1959 NUMBER 4

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The Journal of the Alabama Academy of Science is published four times each year, in July, October, January, and April, and is sent without charge to all members of the Academy.

CONTENTS

OUR MINERAL RESOURCES:

A Discussion of Non-Replaceable Resources

HUGH D. PALLISTER

Geological Survey of Alabama, University, Alabama

Introduction

When men and women came upon this planet, they found land, air, water, the animals of the land, the birds of the air, the fishes of the water, the plants of the land, the air, and the water. The animal kingdom provided food and clothing. The vegetable kingdom gave fruits and vegetables for food, wood for fire and for shelter. Man was compelled to turn to the mineral kingdom for pure, fresh, cold water which with air and food was so necessary for life.

With all of these ingredients of life at man's disposal, his long period of development, progress, and achievement has largely depended upon how he has made use of the minerals created on and in the crust of the earth during its formation but which he could not replace once he used them up.

Now let us consider a few of our mineral resources and how we have used them.

Minerals and Ores

Mineral resources include metallic and non-metallic minerals. Under these are included solids, gases, and liquids. Water is one of the most common and most important of our liquid natural mineral resources. Petroleum and mercury are other important liquid minerals. Natural gas and helium are two of our valuable gases. Iron ore, coal, limestone and dolomite are a few of our solid minerals. In fact, most of our minerals do come under the solid classification. Though some of our minerals are merely curiosities, others are vastly important to human welfare. Of course, scientific research may quickly change unimportant minerals to important ones.

Important minerals or ores are limited in supply in some parts of the world but are very common in other parts. This variability in distribution frequently causes competition between those countries which have and those which have not, resulting in the exchange of minerals needed by one country from another. Frequently other goods or money is exchanged to compensate the countries which have certain desirable minerals. The general practice among various

nations is to use the higher grade ores first with the result that as time goes on lower grade ores must be beneficiated or higher grade ores imported. Improvement in beneficiation of certain ores has materially increased ore reserves from low-grade material which previously was considered non-commercial.

Mineral resources of a country are not replacable as they are mined and used and must be deducted from the ore reserves of that country to determine the ore reserves still on hand. This depletion must be kept in mind in considering the future status of a country.

Past, Present and Future of the Mineral Industry.

Fifty years ago we experienced a great deal of difficulty in finding an alloy in the small world supply which would stand up in machine gun barrels which under rapid fire become heated to dull red heat. Gasoline buggies and early automobiles were coming onto the market and we experienced difficulty in finding suitable steel axles to stand the shock of driving over the rough roads.

Only a limited amount of gasoline was necessary to supply demand for gasoline fuel even when the amount used was probably less than the kerosene used. Today we are confronted by the need of higher and higher grades of gasoline and are constantly looking for more sources of supply. With the tremendous quantities of gasoline used, however, the years of reserves still continue to be as they were 30 years ago; namely, somewhere between 15 and 25 years reserves based on present use. Yet we know that eventually the supply of gasoline from crude oil will gradually be depleted. This depletion means that we will look for other types of fuel such as gasoline and oils from coal, and various radioactive materials.

High-grade iron ores were among the early ores used for production of pig-iron and steel. As the supply of high-grade ore decreased, the ores from many foreign sources were brought into use and beneficiation of low-grade ores gradually increased the tremendous reserves of iron ore in this country and throughout the world.

Coal, which was mined underground fifty years ago by hand or by simple mechanical means, is now mined by continuous high-speed mining methods. Where possible, stripping of coal seams even under a depth of cover of 100 feet or more has gradually taken the place of underground mining of a great deal of coal.

High-grade limestones and dolomites have been quarried and are still being produced in large quantities as flux stone for use in blast furnace or open hearth charges. In turn, slag from blast furnace was used in road and railroad building. This slag is not produced in sufficient quantity to supply the demand for it now; so crushed limestone, dolomite and chert are substituted for it. Pure

limestone is in demand in the lime, cement and chemical industry; while pure dolomite is desired for producing magnesium.

Copper ores were formerly mined only where the ores were rich, but now great massive deposits of extremely low-grade ores are mined. The same is true of many other ores which were previously mined only if they were high-grade, but now, of necessity, lower-grade ores are mined and beneficiated to produce marketable ores.

For the modern automobile we are confronted by the constant search for special alloys of steel and other metals to withstand the strains its high speed develops. For the jet engine it becomes necessary to develop special steels to resist the high temperature attained in these engines and here again special alloys are needed. The development of the modern airplane necessitates the use of lightweight special alloys able to withstand the tremendous strains which occur in the various parts of these planes.

When Dr. Robert J. Van De Graaff, native of Tuscaloosa, Alabama, developed high voltage electrostatic generators which were used in splitting the atom and producing the various uranium compounds, he made it necessary for fellow scientists to search in the mineral kingdom for products which would withstand and protect against the radioactivity developed. The Van de Graaff machine means a great development in the use of special mineral products.

Alabama Mineral Reserves

Alabama is blessed with large reserves of iron ore, coal, limestone, and dolomite—the raw materials for the manufacture of iron products. In addition, its pure limestone is used in the lime, cement, and chemical industry. Furthermore, slag, crushed limestone and dolomite are used in road building. Alabama also is becoming more important as a producer of oil and gas. Then, too, its various clays are producing important ceramic products. The tremendous reserves of pure water and its availability for healthful living, for navigation and for power place Alabama far up the list of important mineral producers.

United States Mineral Reserves

The United States has large reserves of iron ore, coal, limestone, dolomite, uranium and many other minerals so that it occupies a fortunate position in the mineral economic world.

The good-neighbor policy existing between the United States and Canada results in the interchange of the products of the immense mineral deposits of each to the mutual benefit of both. The United States has the policy of paying other nations for what it gets; whereas a few other countries have the policy of taking what they need

without pay and oppressing the people of the lands they rob by force.

Depletion of Mineral Resources

The people of the entire world are depleting their mineral resources at a constantly increasing rate in the development of new products and also in the building of great war machinery capable of blasting each other into dust.

Yet as our minerals near depletion or are restricted by one nation with intent to control the supply, some other minerals or mineral products are found that can be substituted for them and may be superior to them.

The greatest depletion staring us in the face today is that of fresh pure water. The necessity for storage and distribution of flood waters is a major problem. The control and rehabilitation of impending desert areas must be continued, and well-known desert areas could be partially reclaimed through irrigation. Desalting sea water by a cheap method will undoubtedly help to solve the problem. Time is getting short.

In the March 1957 issue of "Fortune" we find an article on the Near East and what one ruler is doing about obtaining pure water.

The ruler of Kuwait (a small country in the Middle East possessing the greatest single pool of oil the world has ever known and presently with the biggest production in the Middle East—1,200,000 barrels a day) has built a two-million-gallon-a-day water distillation plant to free the Sheikdom from its ancient dependence on the dhow-transported water of Iraq. Kuwait is so hot, 127 degrees in summer, that air conditioning is a must and water remains a problem upon which as much time is spent as on oil. The Kuwait sheiks are also supporting a great plan for putting through a pipe line giving them access to Iraq's water. All over the world water is becoming more and more "the precious mineral."

We must bear in mind that the mineral deposits when once used cannot be replaced within the life time of man, and thus we come to the conclusion that these mineral resources must be conserved and used with greater care if the people of the world are to survive.

PHOSPHATE DEPOSITS OF LIMESTONE COUNTY, ALABAMA

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Introduction

The phosphate deposits in Giles County, Tennessee, believed to have "the largest reserves of brown phosphate in Tennessee," extend into Limestone County, Alabama, for about fifteen miles along the Elk River and its tributaries and along the upper part of the Limestone Creek. Weathered Ordovician limestones are the chief source rock for the phosphate deposits, but Devonian rocks contain smaller amounts of phosphatic material where they are exposed in gullies and valleys cut by rapidly descending streams.

Brown phosphate is a term applied to all phosphate derived from the weathering of Ordovician limestone. The term should be treated only in a general way; indeed, much of the prosphatic material is white or gray as well as brown.

Very little detailed work has been done in north Limestone County. Because this part of Alabama represents the southern-most extent of the Elkton-Prospect area of the Giles County phosphate district, it seems that more work is warranted.

Geologic Setting

The phosphatic Ordovician limestones in Limestone County underlie a part of the Tennessee Valley in the southern Highland Rim section of the Interior Low Plateau physiographic province. The county is situated at the southern extremity of the Nashville dome. The Elk River in the northwest and Limestone Creek in the northeast drain the phosphatic limestone areas and are tributaries to the Tennessee River. In these two river valleys the topography is locally hilly. The dissected parts of the Highland Rim have formed hills with a relief of 180 to 220 feet above the creek bottoms.

With a dip to the south that rarely exceeds 40-50 feet per mile the Ordovician limestones are overlain by Devonian shales and sandstones and Mississippian cherty limestones. In a few places the Devonian formations are absent and the Mississippian Fort Payne cherty limestone is in direct contact with the Ordovician limestone. Most of the larger hills in the river valleys are capped by Fort Payne chert. Many low-lying hills of Ordovician limestone have had the

Limestone County, Alabama	South Giles County, Tennessee (Ref. 9)		
	Group	**Formation**	**Thickness in feet**
Chickamauga limestone 100-200 feet thick	Richmond	Mannie shale	0-25
		Fernvale limestone	
	Maysville	Leipers	50-75
	Eden	Inman	0-25
	Nashville (Trenton)	Catheys	40-60
		Bigby-Cannon limestone	60-90
		Hermitage	60-70
	Stones River (Including Black River)		

Correlation of the Middle and Upper Ordovician formations known to outcrop in south Giles County, Tennessee, and Limestone County, Alabama.

overlying formations completely removed, thus providing an ideal environment for the weathering of the limestone.

Character of Deposits

The brown phosphate occurs as blanket, rim and semi-rim type deposits of clayey sandy muck and lump rock. Blanket deposits form on a small hill or knob of Ordovician phosphatic limestone. When a large hill capped by rocks other than phosphatic limestone is subjected to weathering, phosphate deposits form as a rim (collar) around the hill. Should the slope of the hill be gentle, then the term semi-rim is used to describe the type of deposit.

Collophane is the principal phosphate mineral. Chemically it is a carbonate-hydroxyl-fluorine-apatite. The mineral occurs as small nodules and fossil molds not immediately apparent to the naked eye. Associated minerals are dahllite, as fibrous coatings and pore fillings, fluorite, in small amounts and chalcedony, the chief silica mineral.

The phosphate is generally low grade, but flotation methods have been used to concentrate the ore to a commercial grade. Without concentration the siliceous ore has been utilized for electric furnace methods of phosphoric acid production. New methods of electrostatic concentration may be amendable to the use of these low grade siliceous ores.

The nearness of adequate power from the Tennessee Valley Authority electric generating plants and the large reserves of coal for steam generating plants in north Alabama make this phosphate area an advantageous one for electric-furnace phosphoric acid or elemental phosphorous production.

The Tennessee Valley Authority at Wilson Dam, Muscle Shoals. Ala., has planned the following research on phosphate rock beneficiation (Ref. 2):

1. Demonstration plant for production of fertilizer from Florida leached zone ore.

2. Blending phosphate matrix from Knob Creek area in Maury County, Tennessee, with pebble phosphate from Florida to make electric phosphorous furnace charge.

3. Installation of a water scrubbing system for removing fluorine from gases exhausted from the phosphate rock nodulizing kilns.

4. Finding ways to utilize the fluorine-bearing calcium silicate solutions formed in phosphate production.

This increased research program in the adjoining county should serve to emphasize the occurrence of phosphate in Limestone County.

Nineteen weathered samples (Ref. 6) from Limestone County have been analyzed with the following results:

No. of samples	Bone Phosphate of Lime ($Ca_3(Po_4)_2$)
5	60-70%
13	20-50%
1	13%

Origin of Phosphate

A discussion of the origin of the phosphate deposits of Limestone County resolves itself into two parts: the first part is the origin of the source rock or the phosphatic limestone; the second part is the derivation of the phosphate deposit from this phosphatic limestone.

The theory of origin of the phosphatic limestone which appears most easily verified is the one set forth by Smith, 1940, (Ref. 7). He believes the phosphatic part of the limestone was derived principally from a chemical process which formed phosphatic nodules and partially replaced calcareous shells. This theory is opposed to the one previously set forth by Hayes and Ulrich (1903) which suggested that the phosphate was derived principally from the reworking of phosphatic shells of gastropods, brachiopods, etc. More recent work by Dietz, Emery and Shepard (Ref. 3) indicates that below a few hundred meters, sea water is essentially saturated with $Ca_3 (Po_4)_2$ Any addition of phosphate or other reacting element (notably fluorine) or any change in the pH may cause an extensive precipitation of phosphate probably as a colloidal material.

To summarize, an inorganic process probably has played a greater role in the formation of phosphatic limestone than an organic one which depended directly on the extraction of phosphate from sea water by mollusks or other sea life.

The formation of the phosphate deposit is quite different from the origin of the source rock. Two actions, according to Smith (Ref. 7) were necessary to give us a phosphate deposit:

1. A weathering and leaching to give a residually concentrated product.

2. The leaching action re-precipitating colloidal phosphate and replacing calcite with phosphate at a lower level.

Where gravity or vadose water has its greatest freedom of movement minable phosphate deposits are likely to occur. Intervening clay beds will of course limit the formation of minable deposits. A lowering of the ground-water table or uplifting of the area must precede the formation of a phosphate deposit in a limestone situated below the ground-water table.

Summary

Many problems remain to be solved in Limestone County before there is a thorough understanding of the geology and of the feasibility of mining phosphate. The stratigraphy of the Chickamauga limestone of Alabama and its correlation with the Stones River (including Black River), the Nashville (Trenton), the Eden, the Maysville and the Richmond groups in Tennessee is one problem. Limestone County, because of its proximity to Tennessee, is an excellent place to begin the study.

Of course, a detailed mapping of the weathered phosphatic limestones is essential before a successful mining program can be initiated. Great care must be exercised in mapping weathered outcrops because these outcrops are so irregular. Numerous chemical analyses will have to be made.

The formations in which the phosphate deposits of Limestone County occur must be determined.

Further work is planned in Limestone County in an attempt to solve these problems.

* * * * *

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ECOLOGICAL OBSERVATIONS ON THE IMPORTED FIRE ANT, SOLENOPSIS SAEVISSIMA RICHTERI FOREL, IN ALABAMA

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The imported fire ant was first reported from the United States in 1930. At that time, it was well established in the area of Mobile, Alabama. Therefore, it appears that it must have been introduced into the United States from its native temperate South America not too long after the turn of the century.

Distribution in Alabama: Since its introduction early in the twentieth century, the imported fire ant has, slowly at first and more rapidly later, spread from Mobile and Baldwin Counties to the Tennessee state line. The counties south of and including Jefferson are generally infested. The infestations north of Jefferson county are spotty and include infestations in the following counties: Blount, Calhoun, Etowah, Morgan, Limestone, and Walker. A total of forty-four counties and almost nine million acres are infested.

The Habitat: The imported fire ant has been found in all ecological types ranging from hummocks in swamps to the best agricultural uplands. However, the ant shows a decided preference for the infrequently disturbed open types. Permanent pastures, road right-of-ways, and wastelands are preferred. High populations are also found along fence rows, field borders, and woodland edges. The more fertile of these areas tend to support the highest populations.

Few colonies are found in frequently disturbed areas. Plowed fields support a few colonies; however, the infrequently disturbed field borders support high populations whose foraging workers range for several yards inside the cultivated field. In heavily wooded areas the imported fire ant is seldom encountered. This is apparently a reaction to shade, since mounds may be found along woodland roads and in small clearings in such areas.

Although the ants are found in lowlands and even hummocks in swamps they apparently prefer the more elevated well-drained sites. They are found on all soil types and show little preference for any of these. However, they tend to build larger, more conspicuous mounds in the clayey areas, since the forces of nature do not level them as rapidly as those in the more sandy soil types.

Effects of the Physical Environment: The imported fire ant, like

all other living organisms, has an optimum temperature and moisture under which it will best develop. These optima have not been ascertained; however, field observations which show these effects have been made.

It is quite apparent that the ants prefer a relative humidity near the saturated atmosphere of the soil since they come to the surface only on foraging expeditions or in defense of the colony. During rains the ants assume their normal activities inside the mound, only the foraging parties cease their previous work. As the rain continues the ants move up into the mound to escape the water which fills the underground passageways. As soon as the water recedes the normal activities are resumed.

In floods, the colony abandons the mound as soon as the water has reached the topmost parts of the above ground portion. The immature stages are abandoned to the elements and the worker castes form a large ball around the queen and float upon the surface of the water. If a more bouyant object is encountered, the ants will climb upon it and wait until the flood has passed before settling back to earth and building a new mound.

During the flooding of the Alabama River in 1957, a large number of colonies were seen floating downstream in balls, upon logs, and on other debris. Several of these were seen to drift to the water's edge, migrate to the shore and begin new mounds.

The ants react greatly to fluctuations in temperature. Field observations show that during very cold days in winter the ants migrate and carry their brood to the deeper reaches of the nest to escape the cold. If the temperature drops low enough, they will form a protective ball of individuals around the queen and go into a period of torpor until the temperature is raised sufficiently for normal responses to take place.

An experiment by Hays (1958) was designed to determine these temperatures. A laboratory colony of imported fire ants was slowly cooled from room temperature. Activity was noted until the temperature dropped to 11.5 degrees C. although it was considerably reduced above this point. At 9 degrees C. no activity could be seen. There was no response to a vigorous disturbance of the mound. The colony was cooled to a temperature of 4 degrees C. and kept there for three days. When placed at room temperature the ants resumed their normal activities.

Field observations show that at temperatures of 15 to 25 degrees C., the ants may show a normal reaction to external stimuli; however, an examination of the mound shows that the brood and the majority of the worker castes are concentrated just beneath the

surface of the sunny side of the mound. As the sun crosses the horizon the ants follow the warm area produced by the sun's rays and in the late afternoon are concentrated on the opposite side of the mound from morning.

On days of 25 to 35 degrees C. the worker castes as well as the brood are found generally disturbed throughout the mound. There is still a tendency for the brood to be concentrated near the surface. When the air temperature reaches 35 to 45 degrees C. and above, the ants and their brood retire to the lower reaches of the mound. On extremely hot days the greater portion of the ants may be found 2 to 3 feet beneath the surface of the soil.

Various physical factors seem to be, in part at least, responsible for the mating flight. During 1957, mating flights took place during all spring, summer, and autumn months, except during drought periods and winged sexual forms were found in the mounds all year. The greatest number of flying individuals were seen in the spring, although substantial flights were seen during the other two seasons.

Mating flights take place in the morning and are usually completed before noon; however, both males and females may be seen at all times during the day. Frequently, during the mating flight thousands of sexual forms may be seen on the windward side of buildings and in automobiles and houses, where they have been blown by the wind.

The mating flight usually takes place on a sunny morning just after a light rain. It appears that warm temperatures and relatively high humidities are conducive to mating. Hard rains apparently dampen the enthusiasm of the ants since no mating flights have been observed just after downpours.

Populations: In good habitat, stable populations of the imported fire ants average 40 to 50 mounds per acre. The populations occupying any given area fluctuate from year to year, apparently as a function of weather and food supply. During the first one to three years after the migration of the imported fire ant in to a previously uninfested area, there is a tremendous buildup of small colonies. As many as 150 mounds per acre have been counted in some areas. As these mounds grow in size, competition begins, eliminating the weaker colonies and forming a stable population. In some instances physical combat between colonies has been noted. In the laboratory, colonies joined by a glass tube fight until the inhabitants of one mound are completely subdued.

Usually, extreme competition, such as that shown by the imported fire ant, results in uniform rather than random distribution over an area. However, there appears to be no correlation between

the number of mounds and the distance apart. Several large mounds may be randomly clumped in one small area; however, it is believed that in this case the foraging area of each mound is opposite the others and very little overlapping of the home range occurs.

Methods of Spread. In the early history of the imported fire ant in Alabama, the rate of spread was very low. This slow spread may be attributed to several factors. The infested area was small and therefore the supply of mated queens was much smaller than that available later. Also, the spread from a smaller periphery could not have been as great as from the larger one which it slowly formed.

The imported fire ant is a very poor flyer. Under natural conditions, and with the help of favorable winds, it could not hope to extend its range more than 4 to 6 miles per year. However, in the last several years the range has been increased by ten times that rate.

From the time of the introduction of the imported fire ant until it began its rapid spread during World War II, transportation into and out of the infested area was slow and low in volume. Since this time new highways and the more speedy motor vehicles have encouraged a tremendous volume of traffic into and out of the infested area. These automobiles, trucks, and other means of transportation have undoubtedly played an important role in the spread of the fire ant from one area to another. The author has observed mated queen fire ants in his automobile upon a great number of occasions. Once during a mating flight, eighteen were removed from an automobile. Therefore, we may expect our distributional picture to show a number of isolated infestations along highways and railroads.

The Role of the Imported Fire Ant in the Ecological Community: Soil and rotten stumps are the only media utilized for the building of the ant nests. This nest building plays an important role in micro-succession, causing the immediate area to return to bare soil. However, the ants hasten soil genesis in the area by bringing large quantities of sub-soil to the surface where it can more rapidly weather, and thus make its nutrients more available to plants.

The stirring effect of building the nest and its related tunnels helps in aeriation of the soil. This process probably materially assists the nitrogen fixing bacteria inhabitating the heavy, tight, clay soils.

These clayey soils generally are not too permeable to infiltration by rain water. Therefore, a large proportion of the water which falls on these areas is lost in the form of overland flow. Overland flow is the chief ally of erosion. In the areas infested with imported fire ants the many mounds and meandering tunnels dug by the ants serve as conducting channels for the water commonly lost to over-

land flow. Once the water reaches a mound it is immediately conducted underground where it soaks into the soil and is stored for future use by plants. This conduction of water underground helps to prevent erosion as well as helping to restore the water table.

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A CENTURY AND A QUARTER OF SCIENCE AT THE UNIVERSITY OF ALABAMA

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The University of Alabama was founded in the frontier community of Tuscaloosa in 1831, when the war-whoop of the Indian was of recent memory. The first class of students found a Presbyterian preacher in charge and a curriculum covering languages, religion, and moral philosophy, but which was also surprisingly heavy with natural science.

Mathematics was there for disciplining the minds of plantation youths only moderately eager for the joys of learning. If the student survived the mathematical treatment, he was introduced into the mysteries of natural philosophy, which today would be called physics. Then there were courses in natural history, chemistry, geology, and mineralogy.

The turbulent early days of the University saw many changes in the faculty, but the emphasis on science continued through the years, and several members of the science faculty were men of distinction.

Richard T. Brumby, who was professor of chemistry from 1834 to 1848, collected and arranged over 30,000 specimens of minerals, rocks, fossils, and other natural objects for study. Brumby conducted research in goldplating and published the first systematic report of the mineral resources of Alabama.

A new day of science dawned at the University when on March 1, 1838, Frederick Augustus Porter Barnard, known to the students from his initials, "F.A.P.," as "Old Fap," became one of its faculty of five. Barnard assumed the chair of mathematics and natural philosophy, and his coming was attended by a further enrichment of the scientific curriculum.

Educated at Yale College in Connecticut, he had held several teaching positions in the East, although still a young man in his twenties.

Under Barnard's leadership the University established in 1844 one of the finest celestial observatories in the United States, equipped with instruments of great precision. The building, capped by an 18-foot revolving dome, is still to be seen behind Gorgas Hall on the University campus, a striking relic of science on the American frontier. The observatory's fine clock is today keeping accurate sidereal time beneath the copper dome of the new observatory on the Physics Building.

While Barnard was Director of the Observatory, he pursued scientific studies in astronomy to some extent, but the Observatory served mainly as a teaching tool, an adjunct to the mathematics curriculum. Barnard repeated the famed experiment of Foucault, demonstrating the motion of the earth by means of a pendulum suspended ninety feet inside the dome of the state capitol at Tuscaloosa, and he also pursued experiments in photography that led to improvement of the daguerreotype process and gave entertainment to the local public. In 1849 he had himself transferred to the chair of chemistry and natural philosophy. Barnard left the University in 1854 and continued elsewhere in a notable career.

In 1847 Michael Tuomey, a very competent Irishman, came from South Carolina, where he had been the state geologist, to occupy the new chair of mineralogy, geology, and agricultural chemistry at the University of Alabama. A part of his duty was to spend up to four months of each year exploring the state and examining its geology and to publish the results. His geologic exploration was done well, and he effectively laid the foundations for future geologic work.

In 1848 Tuomey became state geologist, and the legislature made an appropriation for what later became the Geological Survey, which from its inception was located at the University.

Tuomey's successor in 1855 was another Irishman, John W. Mallet, who held the degree of doctor of philosophy from the University of Gottingen. While at the University of Alabama Mallet made the first reported atomic weight determination in the United States. After leaving in 1860, he served for one year as professor of chemistry in the Medical College of Alabama, then continued elsewhere in the South in a distinguished career. A bibliography of Mallet's works covers over a hundred titles.

Before the Civil War the University never had over 138 students, and the number of professors ranged from five to seven. The war saw a large increase in enrollment, a speeding up of the educational

process and an emphasis on engineering. The University was burned by Federal soldiers in 1865, thus ending its activities for several years. After a period of carpetbag management, it opened its doors in the fall of 1871 with a competent faculty.

A notable newcomer of the new era was Eugene A. Smith, Ph. D. (Heidelberg), an Alabamian and a graduate of the University of Alabama in 1862. A man of energy and ability and of professional training of the highest order, Smith became in 1871 professor of mineralogy and geology and in 1873 state geologist. For some years he also served as professor of chemistry. For 45 years he was the leading figure in science at the University. Smith taught during the school terms and diligently pursued his geological survey of the state during the summers.

Starting with the large geologic collection of Professor Tuomey, which had been saved from the fire in 1865, Smith expanded it by inviting interested persons to send him mineral specimens, ores, and fossils from anywhere in Alabama, labeled and packed according to his specifications. By 1866 the collections had become so large that most of them remained packed in boxes, for want of space for their proper display. In 1892 the first floor of the new Garland Hall was dedicated to museum purposes, and in 1909 Smith Hall, especially built for the museum, gave a home also in its wings to the geological and biological laboratories.

Smith was a familiar figure to the railroad conductors, who were often instructed to put him off in the middle of the swamp or some other remote place. He mapped the geology of the state in a most thorough fashion. In his annual reports as state geologist his activities are chronicled.

The University curriculum in the forty years following 1871 continued to reflect the emphasis on chemistry and geology that dated from the earliest days. Smith's colleague in science in the 1870's and 1880's was Joshua H. Foster, D. D., professor of natural philosophy and astronomy, who also on occasion taught moral philosophy, which very probably also sometimes crept into the natural philosophy, in accordance with the manner of the times.

In 1897 the Board of Trustees voted to establish a chair of biology, but in trepidation, lest this action subject the University to the charge of godlessness. The man chosen to fill the place after giving assurance that he was a staunch Presbyterian, was John Y. Graham, who, after three years at the University of Munich, had just received his Ph. D. degree, **magna cum laude.** Graham had recently discovered the important **Trichinella spiralis** parasite in a raw pork and traced a part of its life cycle. His long and distinguished teach-

ing career in biology and the related sciences, begun at the University of Alabama in 1897, continued there until his retirement.

Two other men of science who gave the most productive part of long careers to the University of Alabama were Stewart J. Lloyd, professor of chemistry, metallurgy, and geology, a Canadian and a doctoral graduate of the University of Chicago, and Jack P. Montgomery, professor of chemistry, who obtained his doctoral degree at the University of Virginia. Lloyd came to the University in 1909 and Montgomery in 1911. Dr. Roland M. Harper, taxonomist and geographer, whose first connection with the Geological Survey began in 1905, is another scientist with a long connection with the University. His scientific tracts are widely known and often cited.

From 1890 to 1912 a rather considerable number of well-trained men of science spent a few years at the University, and since the latter date the list has grown increasingly long.

Always associated with science have been the Department of Mathematics and the College of Engineering, the School of Mines (established in 1920), and the Southern Experiment Station of the United States Bureau of Mines, which has its own laboratories in its own building on the campus.

The Geological Survey, legally separate from the University, has engaged in archaelogical explorations at Moundville and elsewhere since Smith's retirement.

The Medical College of Alabama was founded in Mobile in 1859 by Josiah Clark Nott for training physicians. Although nominally a part of the Universty from the beginning, it had its own board of trustees. In 1906 all the property was transffrred to the University, and it became the School of Medicine; then in 1920 the two clinical years were abolished, and it was moved to the main campus at Tuscaloosa. The reorganized two-year school met the rising standards of accrediting agencies and was staffed with a well-trained faculty. In 1945 it was moved to Birmingham, where it became again the four-year Medical College of Alabama and operated on an expanded scale. Its facilities have been greatly improved since that time. Independent of the school of medicine has been the recent establishment of a collegiate school of nursing on the University campus at Tuscaloosa.

Several of the alumni and faculty of the University have distinguished themselves in medicine. Dr. Joseph Clark Nott published nearly 70 papers of one kind or another and is reputedly the first to suggest that insects could transmit yellow fever. Dr. LaFayette Guild was Surgeon and Medical Director of the Confederate Army of Northern Virginia from 1862 to 1865. Dr. George H.

Searcy at the Mt. Vernon state hospital was the first to recognize pellagra. Dr. Seale Harris discovered hyper-insulinism. Dr. Roy Rachford Knacke discovered agranulo cytosis and received various awards therefor. Dr. Robert Hingson was the leading figure in the development of caudal anesthesia. Dr. Neal Owen is a leading plastic surgeon and author of a book on burns. Dr. George T. Pack has become a renowned authority on cancer. And quite recently Dr. Sterling Edwards of the surgery department developed a nylon tube to replace damaged blood vessels.

Through the University's history its primary function has been that of disseminating learning. Thousands of students in the basic sciences have had their lives enriched and their understanding of the world improved. Hundreds of teachers have been trained to carry knowledge of science to the youth. The training of technicians for industry has been a vital service to the state. These functions the University has performed and performed well, with very limited means.

That the faculty has not been made up of mere purveyors of information, however, is attested by the fact that several of the University's scientists can count over a hundred titles of published works bearing their respective names.

The University Research Committee, which was set up in 1943, administers a fund made available by the legislature to aid the faculty in productive research. The catalytic effect of the expenditures for this purpose has been far greater than the relatively small amounts of money involved can possibly suggest.

Since World War II the University has added to its former functions that of training scientists and college teachers of science in the program leading to the degree of doctor of philosophy. Such a program of teaching at the philosophical level calls for a faculty which is actively and professionally concerned with the discovery of knowledge as well as with its dissemination. At the present time, the faculty is struggling to meet the challenge. The doctor's degree is now offered in chemistry, biology, and physics. There have been several graduates in each and numerous others are expected soon.

The School of Chemistry has its own building and 23 professors, who teach an elaborate array of courses in chemistry, metallurgy, and bacteriology to suit a wide variety of needs. Its first doctoral degree was granted in 1952. The opening of the government facilities at Oak Ridge, Tennessee, to summer work by this faculty has been in recent years invaluable.

The Department of Biology granted the first science doctorate at the University. Its full-time staff is composed of eight biologists

of thorough professional training, and its building is appropriately located on the site of the former house of Professor Graham. Its research facilities are adequate, and members of the staff are making studies of algae, plant physiology, vertebrates, and other subjects. A large part of the department's work is in the teaching of introductory courses in biology and providing basic science education for pre-medical and pre-dental students.

The Department of Physics, with a staff of seven professors, which occupies a commodious new building with modern laboratories completed in 1950, has been deeply influenced by the recent emphasis on, and discoveries in, the field of nuclear physics. A research participation contract allows faculty members to spend frequent summers in the government laboratories at Oak Ridge, the facilities there being likewise open to graduate students who may need them. Since 1955 the department has had four doctoral graduates. Enrollment, especially of graduate students, is rapidly increasing. The department participates in a cooperative educational program with the Redstone Arsenal at Huntsville. Acquisition of a large quantity of war-surplus equipment has strengthened the research facilities of this department. Members of the faculty are active in the search for new knowledge in radio astronomy, nuclear magnetic resonance, infra-red spectroscopy, and other fields. Especially helpful in the doctoral program is the Temerson chair of physics, endowed by three Temerson brothers of Tuscaloosa.

One alumnus and one faculty member who have had distinguished careers in physics need to be mentioned. Dr. Robert Vandegraf, an alumnus, is the inventor of a machine which can literally make your hair stand on end: the famed Vandegraf generator of high voltage static electricity. Even more impressive is the current responsibility of Dr. Arthur E. Ruark, Temerson Professor of Physics, currently on leave, who is chief of the Thermonuclear Branch of the Atomic Energy Commission, working on the peacetime use of thermonuclear energy. His job, in more dramatic terms, is the important one of taming the "H" bomb.

As we look back over a century and a quarter of science at the University of Alabama we can see a long history of teaching by many very competent and devoted men and women, of individual research, which, although never the main emphasis, has in sum created an impressive amount of new knowledge. Today we see the University entering a new era and straining at its resources to meet the challenge of a new day.

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THE FORMATION OF PYRITE, MARCASITE AND OTHER SULPHIDES IN RECENT OR LATE GEOLOGIC TIME

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Introduction

We have been intrigued by the many and varied occurrences of both pyrite and marcasite in many different kinds of rock formation, particularly in the Coastal Plain area of Alabama as well as the contact between the Coastal Plain and Paleozoic rock formations.

The pyrite and marcasite occur either in individual crystals or in large masses, and in other cases as cementing material between pebbles and other mineral grains. They are frequently in contact with bituminous matter of comparatively recent origin.

It is sometimes difficult from the crystal structure to determine the difference between the pyrite and the marcasite. This has led us to turn to the writings of Frank W. Clark (1). He discusses the formation and origin of pyrite, pyrrhotite and marcasite as well as some other sulphides. He points out that marcasite can form at ordinary temperatures; that pyrite usually is formed at slightly hotter tem-

peratures and that at 450 degrees marcasite has been known to be transformed into pyrite.

In determining pyrite and marcasite, E. T. Allen and J. L. Crenshaw (2) used the Stokes Method and found that with marcasite by using a standard solution of ferric sulphate and boiling this with marcasite, iron sulphide, that ferrous sulphate and free sulphur were produced in large amounts. Only about 12% of the sulphur in the marcasite was oxidized; while in the case of the pyrite under the same treatment, about 52% of the sulphur in the pyrite was oxidized to sulphuric acid. With careful manipulation the Stokes method can be used to determine whether the mineral is pyrite or marcasite.

Description of Deposits

During the past two or three years in his search for uranium, Mr. C. W. Bozeman, a young Tuscaloosan, brought in a great number of samples to the Geological Survey of Alabama. Among these samples there was quite a bit of pyrite and marcasite. The bright shiny crystals naturally attracted his attention. One especially interesting deposit occurred in the gravels of the Tuscaloosa formation along the edge of a recent coal stripping operation in Tuscaloosa County off the old Birmingham highway a short distance east of Peterson. Here Mr. Bozeman found numerous quartz and chert pebbles cemented together by a recent occurrence of pyrite which seemed to indicate that the coaly material from the adjoining stripping may have had some bearing on the deposition of the pyrite. He also found a number of occurrences of marcasite forming, apparently in fairly recent time, around woody material, such as roots and tree branches. One such occurrence was in clay on the south bank of the Warrior River between Tuscaloosa and the Oliver Dam.

The senior author and the late Charles Morgan in the course of a lignite survey of the Coastal Plain of Alabama found evidence of marcasite nodules in the lignite beds. One particularly interesting occurrence was discovered in Wilcox County in a branch of Gravel Creek in the SE¼ of Section 15, Township 11 North, Range 7 East, where immediately above a 3 ft. 6½ inch solid lignite bed was found a 4 inch layer of hard marcasite in contact with the upper surface of the lignite bed. It would appear that the lignite had something to do with the formation of the marcasite.

Messrs. Hastings and Daniel visited many of the occurrences located by Mr. Bozeman and found that in most cases the pyrite or marcasite was closely associated with woody material.

Some further interesting occurrences which may be worthy of note are instances of a secondary enrichment of the Chattanooga shale in DeKalb County. About 4½ miles north of Valley Head on

a hill-side road west of U. S. Highway 11, Prof. George D. Swingle and State Geologist, W. D. Hardeman of Nashville, Tenn., found high grade uranium in Chattanooga shale (3). The Chattanooga shale frequently carries a small amount of pyrite and uranium. The first three authors of this paper visited and had no difficulty in locating the hot spot by a scintillator. The beds are inclined at a dip of about 45 degrees and much of the original Chattanooga has been weathered and removed by erosion and the dissolved uranium has percolated down into the Chattanooga shale. As this has occurred, it is possible that the solution containing uranium in filtering down through the Chattanooga shale deposited out and enriched this shale raising the uranium content to an abnormally high degree.

Another deposit was noted by the writers in Marion County, Alabama, where two superimposed beds of Coal Measure sandstone, each about 40 feet in thickness, occurred with a small bituminous parting. A small amount of water oozing out between these two beds deposited on the thin layer of bituminous matter a thin film of a high radioactive matter, but too thin to be of commercial importance.

Another deposit was discovered on the 50 foot level in an old working in the Stone Hill Copper Mine in northern Randolph County. Water percolating from the overlying bed picked up low grade copper and iron sulphates dissolved from the copper and iron oxides, carbonates and sulphides. When this solution reached the ceiling of the old mine working, beautiful sky blue crystals of the mineral chalcanthite, copper sulphate, were formed.

Conclusion

The iron and sulphur must have been carried in a ferric or ferrous sulphate solution. When it came in contact with the decaying vegetable matter, it is possible that the hydrogen sulphide was formed by this decaying material and it in turn reacted on the ferric or ferrous sulphate to bring about the deposition of the iron sulphide. If normal temperatures prevailed, the chances are the material deposited would be marcasite. If, on the other hand, the deposit was subjected even to the heat of the sun on hot days, the marcasite or the heated solution might possibly have deposited the pyrite.

1. Sulphides by F. W. Clarke. The Data of Geochemistry (5th Edition) U.S. Geological Survey Bulletin 770, Washington, 1924, pages 336-339.

2. The Stokes Method for the Determination of Pyrite and Marcasite: by E. T. Allen and J. L. Crenshaw. The American Journal of Science, (4th Series) Volume XXXVIII (1914) pages 371-431.

3. A paper before the Tennessee Academy of Science at a recent meeting.

THE RESPONSE OF MANAGERS IN AGRICULTURE TO RESOURCE AND PRODUCT PRICE CHANGES

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Managerial functions arise from entrepreneur possession of imperfect knowledge about changes. Changes may be of an experienced or expected nature. Individuals may differ in their classification of change, but any classification advanced doubtless has price or some semblence thereof as a major element. Price changes deserve recognition in terms of the resources being combined in the production process and the result of that combination, the product.

Description of experienced price changes and some form of prediction of expected price changes have been treated in considerable detail by the U.S.D.A. and the cooperating Land-Grant College system for about three decades. Private commercial management agencies have attempted to render similar type services. Both private and public agencies have largely concentrated on the nature of the change experienced or expected rather than upon interpretation of the meaning of such occurrences or predictions for the managers of farm businesses.

Consideration of the past efforts of economists in the area suggested by the title of this paper may best be limited to contemporary works in the interest of brevity. Schultz's identification of the weaknesses in current farm management efforts and his challenge to economists to place their "shoulder to the wheel" in his address in 1938 to the American Farm Economics Association serve as a convenient bench mark for this discussion (1). Later, he and Brownlee made two trials to investigate the nature of the expectation models applicable to agriculture (2). Brownlee working with Gainer later attempted to secure more precise notions regarding the nature of farmers' anticipations (3). W. F. Williams and Pritchard at the Purdue Station observed the relationship between expressed expectations and the consequential action among dairy farmers in the Evansville, Indiana, milkshed (4). Brewster and Parsons have very strikingly raised the question of whether prices do actually allocate resources (5). Glenn Johnson and associates at Kentucky sought to identify the price element in its role in a decision-making framework relative to the other types of changes which managers encounter (classifiable as human, technological, institutional and physical). (6, 7, 8).

We are familiar with the traditional treatment of the adjustment of the firm to price changes under different market conditions as advanced in the classroom and in the economic works occupying the shelves in our offices and of the libraries of the institutions which we represent. The **ceteris paribus** assumptions are very much characteristic of these efforts. These assumptions are not necessarily valid. Certainly something must be amiss when many weekly newspapers in Alabama carry a feature article by a leading agriculturist predicting higher hog numbers, lower price for hogs; yet, suggesting that farmers expand their hog numbers.

What action should a farmer take on the basis of increased price for his product? Decreased price for his product? Increased cost of his resources? Decreased cost of his resources? What adjustments are suggested if resource and product prices are expected to remain unchanged? These questions appear to be extremely important in endeavors in the agricultural and other forms of industries.

A thorough treatment of these questions requires detailed reconsideration of our theory of the firm which is very much needed as evidenced by some contemporary writers (9). The undertaking of such an assignment in the remaining time allotted is beyond reasonable expectations, but we do wish to share with you some of our experiences in dealing with the price element in our management research. We first wish to draw upon the research of the senior author working as a part of the Interstate Managerial Study.* We will then mention some of our research underway in Alabama, most of which is still in the pre-analysis stage, but all of which deals directly or indirectly with the topic being discussed. We also wish to advance some implications of the endeavors.

Resource Price Change

The works cited above emphasized the expectation phase of price changes. Research has not approached a detailed treatment of managerial adjustment to experienced price changes. One phase of the Interstate Managerial Study dealt with the nature of managers'

*A cooperative interdisciplinary study by personnel of the Agricultural Experiment Stations of Kentucky, Indiana, Iowa, Kansas, Michigan, North Dakota and Ohio, dealing with information types, sources and uses; analysis problems and processes; expectation models; personal strategies; and managers' willingness to accept responsibility relative to possible losses and gains. For details of the nature of this study, see Harald R. Jansen, *et. al.*, "Progress and Problems in Decision Making Studies," *Journal of Farm Economics*, Volume XXXVII, December, 1955, pp. 1097-1125. The senior author of this paper gave a partial report of the findings in his doctoral dissertation, "An Empirical Study of the Decision-Making Process in Farm Management," Purdue University, 1956.

production process adjustments to changes in the price of items bought and used in production. The observations were made by the method of decision reconstruction using enumerators selected and trained for this specific study. These adjustments were thus recorded on an **ex post** basis and the price movements represented big changes in the thinking of the respondents. We estimated from our sample that nearly ½ (48.5 per cent) of the managers in the population (single managerial non-livestock lease units with gross income of not less than $2,500) definitely had not adjusted their production and that about one-fourth (25.1 per cent) of the population definitely did adjust their production as a result of the "big" input price change. The number of managers who indicated that the input price had fallen was very small, and the replies represented only individual observations rather than a basis for meaningful population estimates.

The nature of the production changes for the managers who reported such response accompanying an input price **increase** (60.7 per cent of the observations) were: went out of production, 2.8 per cent; reduced output, 7.2 per cent; increased use of substitute with no change in output, 7.6 per cent; adopted a cost reducing technology and/or practice without a change in output, 6.5 per cent; increased use of substitute with unknown effect on output, 23.7 per cent; increased output, 8.4 per cent; effected the change for other reasons 4.5 per cent. Reasons recorded for managers' increasing their output as a result of increase in price of input were: :(1) price of input was still less than the returns from its use, (2) increase in output price more than offset the input price change, (3) cost reducing technology and/or practices were introduced, and (4) production was necessary in order to maintain income.

The most striking relationship evidenced in the study of the tendency to adjust to input price changes and selected variables dealing with characteristics of the farm and family was a direct one between the net worth of the managers and their tendency to adjust.

Product Price Change

Information was obtained, in a manner similar to the resource response, on the nature of manager's production process adjustments to changes in the prices of items produced for sale. Managers were asked to identify an item produced for sale which had had a rather drastic change in price recently, the direction of the price change, and to reconstruct their decision as to the adjustment resulting or not resulting from the price change.

The 11.8 per cent of the managers reporting an output price in-

crease consisted of 3.7 per cent who changed their production, 7.1 percent who did not adjust their production as a result of the price change, and the response of 1.0 per cent was not ascertained.

The 83.9 per cent of the managers reporting an output price **decrease** consisted of 31.4 per cent who changed their production, 44.9 per cent who did not change their production as a result of the price movement, and 7.6 per cent for whom the nature of the response to the price movement was not ascertained.

Summarized, it was estimated that 35.1 per cent of the managers adjusted their production as a result of the output price change, that 52.8 per cent of the managers did not adjust their production for this reason, and that for 12.1 per cent the nature of their reaction to output price movements was not ascertained.

The most meaningful reasons advanced dealt with the managerial response to output price decreases. Reasons advanced for decreasing production with a **decrease** in price output were interpreted to be that: (1) the price for the output had fallen, (2) better output alternatives existed, (3) bias against this type of output was present, e.g., personal preference, and (4) input costs were too high relative to the new output price.

Reasons advanced for not changing output with a decrease in price were interpreted to be: (1) no other alternatives were recognized if respondent wished to remain farming, (2) price expectation the opposite of current prices was held and/or price of the product was expected to "average out," (3) personal preferences, (4) change was too risky, (5) needed income and/or maintenance of production because: (a) cost structure could be, will be, or must be lowered or (b) marginal cost was no greater than new price.

RESEARCH UNDERWAY

It is more interesting to view the situation here at home than in other farming areas of this country or abroad. Also it is hypothesized that observations and analysis in the South may disclose different findings than would similar observations in other areas. Since we all advisedly study the past when it may be of use to us in the future, it is not unrealistic to refer to the major differences of the past in the Southeast and other farming areas. Such contrasts suggest differences between the managers in the two areas in the present and future, even though this difference with time may become minimized at an increasing rate.

Our current research deals with farm and home managerial opportunities and adjustments in Alabama agriculture. This project is in cooperation with personnel of the Alabama Agricultural Exten-

sion Service, and the observations were made by personal interview of Extension agents and cooperating Farm and Home Development (FHD) families in sixteen Alabama counties. The sample of families was selected at random within type of farming area strata and consists of FHD families in which such activities are undertaken by the Extension Service on an intensive basis. Subjective and objective type questions were both included in the study. We are currently coding and processing the data to facilitate use of IBM equipment.

We have attempted to delve into the problem recognition area of managerial behavior. Observation of individual opportunities as viewed by the managers themselves is expected to reveal interesting bench marks for future educational and research endtavors. The price and non-price facets of problem recognition have been observed. Problem recognition is believed to be a major phase of any consideration of the decision-making processes in management and a phase largely ignored by Johnson and associates. (6, 7, 8).

We have obtained information on managers' tendency to keep up with the farm price outlook, and to a limited extent, the use made of such information. Very preliminary estimates from our sample disclose that 52 per cent of the managers recognize that they keep up with price changes and outlook information in general, and that 34 per cent observe such information on a few items in which special interest is characteristic. About three-fourths of those keeping up with such information have indicated that they are making use of the information in some manner.

Current emphasis on price legislation and other reasons prompted exploration of the minds of the families relative to the opportunity for profit enhancement through non-price adjustments. Also the role of price alongside the non-price adjustment in a profit enhancement objective situation is included in the study.

Some Implications

The merits of this paper lie with the identification of the inadequacies in the treatment of price by agricultural researchers and educators concerned with management. In seeking new frontiers, we doubtless may be fruitful, but the greatest reward may lie with our examination of the economic knowledge we tend to accept without question.

The assignment of researchers and educators in farm management economics is to develop a framework for use in decision-making, to assist in the observation of price and production coefficients to use in this framework, and to assist in the analysis of these coef-

ficients in the interest of choosing from alternatives. The difficulty lies not with the roof for the framework but with its foundation, the economic theory of the firm.

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RECENT TRENDS IN AGE AT MARRIAGE, WITH SPECIAL REFERENCE TO COLLEGE STUDENTS

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The average age at marriage varies in different countries and states, and with different races and occupation groups, but until rather recently it did not seem to change much from one generation to another in any one community and population group, though economic and political conditions might cause minor fluctuations.[1] A generation or so ago it seemed to be a common belief that young people were marrying later than their parents and grandparents did, largely because more of them were going to college and settling in cities, and it took them longer to become self-supporting than it did those who lived on farms, as most Americans used to. It was customary then for scientists and other educated people to finish their education and get established in a job before marrying, and then marry at the average age of about 30, with brides about 27, as compared with about 28 for their fathers and 23 for their mothers.[2]

Marriage is generally a little later in Europe, especially northern Europe, than in the United States, in the northern than in the southern parts of our country, and among whites than among Negroes. In India until quite recently child marriages, arranged by the parents, were the rule, and there were even a few widows under a year old.

In Italy the earliest marriages are in the southern part of the country (which has the most illiteracy), but the first World War caused a delay of a year or two in the average age of marriage in all sections, perhaps because the young men were not expected (or allowed?) to marry until they had completed their military service. In this country the depression of the 30's caused many marriages to be postponed; but the second World War, immediately following, speeded up marriages, presumably because young men hoped to escape military service by marrying, and many girls were glad to marry at the first chance, fearing a shortage of men after the war.

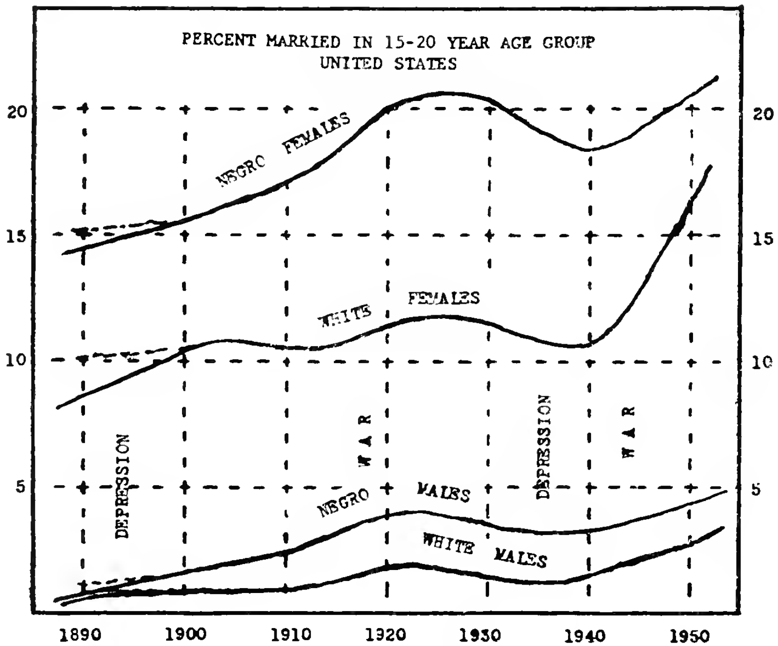
Some foreign countries give statistics on age at marriage, but we do not have much information of that sort for the United States, un-

[1] See graph on page 365 of my paper on a statistical study of a typical southern genealogy, in the Journal of Heredity (Washington) for September, 1934. Also Jour. Ala. Acad. Sci. 27: 73, 75. 1956.

[2] See Cattell's American Men of Science, ed. 3 (1921), page 792.

til quite recently, and then not for all states. But statistics of marital condition, which go back to 1890 for the whole United States, and earlier for a few states and cities, afford a good indication of trends. For example, we can take the percent married in the 15-20 year age group, and see how that varies from one census to another.

A census of Charleston, S. C., taken in 1848 by local authorities, gives some statistics of marital condition of the white population, over forty years before we had anything of the kind for the whole country. It shows that in the population between the ages of 15 and 20 none of the males and 9.42% of the females were married. These figures are not very different from those for 1890 on the graph here presented, and we may guess that this was pretty typical for the whole 19th century. (The Charleston report gives comparable figures, but without classification by age, for Boston in 1845 and a few European countries in 1841.)



Graph showing the percent married in the 15-20 year age group, in the whole United States, 1890 to 1950, separating races and sexes. The dotted lines between 1890 and 1900 are based on estimates for 1890, on account of a different method of reckoning ages in that year, as explained in the text.

The approximate dates of depressions and wars are indicated.

This graph shows the percent married in the 15-20 age group in the whole United States from 1890 to 1950, separating races and sexes. At some censuses the data were given for all colored, or "non-white," instead of for Negroes only, but that makes very little difference in the ratios, and has not been allowed for here.

In using the census data it is necessary to bear in mind that in 1890 all ages were referred to the nearest birthday, instead of to the last birthday as at all other censuses. So it must have included a smaller proportion of married persons than it would have otherwise, on account of the many marriages, especially of women, around the age of 20. It would be difficult if not impossible to make an accurate adjustment for this in the statistics, but in the graph I have added some dotted lines for the decade 1890-1900, to show the probable true conditions at that time.

Some of our recent censuses give statistics of marital condition by single years; but to go back all the way to 1890 we have to use five-year groups, and that of 15-20 years corresponds most nearly to the age of college students, who are especially considered here. In my college days, at the University of Georgia in the 90's, scarcely one per cent of the students (all males) were married; and I do not recall any married students at the University of Alabama a decade later, though coeducation had then been in effect there for about ten years. But now married students are common on most campuses. A cartoon that I remember seeing a few years ago showed a young couple wearing caps and gowns, on Commencement day, saying to two small children: "Now be good while we go and get our diplomas," or something to that effect.

Some figures on marriage of students have recently appeared in a rather unexpected place, an 11-page U. S. Census bulletin (Series P-20, no. 80), on school enrollment in the United States, as of October, 1957, published in February, 1958. Among other things, it gives some statistics of marital condition, and shows that 28.8% of the male college students, and 9.8% of the females, were married and living with their spouses. (Presumably there were a few others once married but now separated, widowed or divorced). There was also a considerable percentage of high school students married. But there was a great difference between full-time and part-time college students in this respect. Married men constituted 16.6% of the full-time and 65.2% of the part-time male students, and married women 3.6% of the full-time and 27.4% of the part-time female students. However, these figures were considerably less than those for the non-

school population of corresponding age, except for the part-time male students. The bulletin referred to does not separate races, but those for whites only, in college, should not differ much, for probably 95% of our college students are white.

The higher figures for females than for males on the graph are due to the fact that women mature and marry earlier than men, throughout the world; and furthermore, a woman likes to have a husband a little older than herself anyway, for protection, support, etc. But there are many more married men than women in college, for the obvious reason that a man can raise a family while getting his education much more easily than a woman can.

The higher figures for Negroes than for whites on the graph simply reflect a racial difference (one of many).

The decreasing age at marriage, as shown by the increasing proportion of married persons at younger ages, can be attributed to several factors. One, the war, has already been mentioned, and that still operates indirectly, for we still have conscription, and threats of another war.

Another important factor is spoiled children. Children these days have fewer brothers and sisters and more luxuries than their parents did at the same age, and are apt to be pampered and spoiled. The adolescents or "teen-agers," or many of them at least, now think they ought to be allowed to do whatever adults do, such as drive automobiles, and commit crimes of various kinds; and for a few years past they have been allowed to vote in Georgia and Kentucky on reaching the age of 18. So they do not like to have to wait for anything they want, such as a wife or husband.

Another factor that had developed especially in the last two decades is the paternalistic policy of our government, which aims to relieve the citizens of responsibility as much as possible, as if they were children; so that they do not have to plan much for the future, or try to have some money saved up before embarking on the sea of matrimony. For the Negroes this may be more significant than the spoiled child factor.

Depressions and wars are indicated on the graph. The depression of the 90's did not seem to have much effect on the age of marriage, if I have estimated the true figures correctly. But that of the 1930's caused many marriages to be postponed, as already stated, and as some who read this can probably remember.

Separate data of this sort could be had for other age groups, for

natives and foreigners, for the urban and rural population, and for single states; but it would take too long to go into all that. I might say here, however, that marriage used to be later in cities than on farms, in spite of the larger proportion of spoiled children in cities, largely because the average city dweller had spent more time in getting an education than the average country dweller; but now there does not seem to be so much difference.

Whether early marriage is good or bad is debatable. A generation or so ago some idealists thought young people ought to marry as early as possible, perhaps on the theory that that would not give them much time to "sow their wild oats." But it is now generally believed that people who marry early are more likely to be divorced than those who wait until they are old enough to have more judgment. However, it is easy to find exceptions, and at the same time it is believed that college graduates are less addicted to divorce than uneducated people.

There seems to be a tendency for young parents to have healthy children and old parents smart children, but that is hard to prove, for there are other factors involved, and many exceptions. This is just a hypothesis, but if there is anything to it, it might help explain why the American people are now living longer than ever before, and also why their intelligence seems to be declining, as shown by the large proportion of young men now being rejected for military service on account of mental deficiencies, the increasing popularity of Communistic ideas, and the kind of men our ignorant voters are electing to public office these days.

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Carmichael, John L., 3522 Salisbury Rd., Birmingham .... MS
Carr, Howard E., API, Auburn .... PM
Carter, Hugh P., 503 Title Guarantee Bldg., B'ham. .... SS
Casey, Albert E., 2236 Highland Ave., Birmingham .... MS
Cason, Louise R., Med. College of Alabama, Birmingham .... MS
Chaney, David W., Chemstrand Corp., Decatur C
Chapman, Warner E., P.O. Box 241, Montgomery .... BS
Chastain, E. D., Jr., API, Auburn .... SS
Cheraskin, Emanual, University Med. Center, Birmingham .... MS
Chermock, Ralph L., Box 2047, University .... BS
Clark, Father Victor J., O.S.B., St. Bernard Abbey,
St. Bernard ....
Clemmons, Ballard H., Bureau of Mines, Box L, University .... GA
*Cobun, Ted C., Indian Springs School, Helena .... SE
*Coffman, Lindsey F., Marion Institute, Marion .... SE
Cole, Frank T., 562 Tuttle Ave., Mobile 19 .... FGC
Coleman, John S., Birmingham Trust National Bank,
Birmingham .... IE
Conway, Ophelia A., Rt. 1, Maplesville .... SE
*Conway, R. A., Goshen High School, Goshen .... SE
*Cooper, Opal, Cullman High School, Box 318, Cullman .... SE
Covington, Perry C., 316 W. Glenwood Dr., B'ham. .... IE
*Cowart, Mrs. Gladys, Troy High School, Troy ....
Craddock, Emma A., 1C Azalea Court Apts., Mobile .... BS
Crafts, Arthur G., API, Auburn .... PM
Craig, Alfred B., 2100 Stratford Rd., Decatur C
Croker, Thomas C., Jr., Box 311, Brewton .... FGC
Culmer, Orpha Ann, Florence State College, Florence .... PM
Curl, Elroy A., API, Auburn .... BS
*Cyr, Brother S. C., McGill High School, Mobile .... SE
Dale, William P., II, Howard College, Birmingha m .... SS
Daniel, Thomas W., 113 Cedar Crest, Tuscaloosa .... GA
Davey, Bessie L., Box 2634, University .... BS
Davis, Donald E., API, Auburn .... BS
Dawson, Margaret U., Rt. 1, Box 156, Auburn .... SS
Dean, Blanche, 1228 S. 29th St., Birmingha m .... BS
Decker, Mary G., 107 Bloch St., Montevallo .... BS
DeJarnette, David L., Box 66, Mound State Monument,
Moundville .... GA
DeVall, W. B., 169 Bowden Dr., Auburn .... FGC
Devonshire, L. N., D-4 Stoneleigh Court Apts, Tuscaloosa C
DeWitt, Thomas W., Chemstrand Corp., Decatur C
Dickinson, Harry E., 8213 10th Ave. South, Birmingham .... SS

Diener, Urban L., API, Auburn .... BS
Dietz, Robert A., Troy State College, Troy .... BS
*Dorris, E. G., Coffee High School, Florence .... SE
Doster, Mrs. Charles S., 2924 Hastings Rd., Birmingham .... BS
Doster, James F., P.O. Box 1955, University .... SS
Doubles, James A., Jr., Birmingham-Southern College, Birmingham .... BS
Douglas, Sarah F., 212 Mecca Ave., Birmingham .... BS
Dowdy, Felix, International Paper Co., Mobile .... FGC
**Duncan, Archie B., 213 49th St., Fairfield .... BS
Dunning, Abram B., Box 599, Room G-309, Fairfield .... PM
**Durham, David P., Rt. 1, Box 41, Harpersville .... GA
Eden, William G., API, Auburn .... BS
Edwards, O. W., Tennessee Valley Authority, Wilson Dam C
**Eich, Foster, III, Fort Davis C
Eisele, Louis J., Spring Hill College, Spring Hill .... PM
Elder, A. H., 1613 32nd Ave. North, Birmingham C
*Elizabeth, Sister Mary, John Carroll High School, Birmingham .... SE
Elliott, Howard C., Jr., 405 16th Place, SW, Birmingham C
*Ellison, Dorothy S., Dora High School, Dora .... SE
Elton, Carey F., 728 Berea Ave., Gadsden .... PM
Emerson, Jack D., University Medical Center, Birmingham .... MS
Engelbrecht, Mildred A., Department of Bacteriology, University .... BS
Estes, Edna E., Box 2224, University .... BS
Evans, E. Edward, Jr., University Med. Center, Birmingham .... MS
Evans, Lawrence E., 203 Gardner Drive, Auburn .... MS
Evers, Ray, Andalusia .... MS
Ewing, Carolyn B., 901 Oak St., Montevallo .... BS
Farish, Preston, API, Auburn .... BS
†Farmer, C. M., Troy State College, Troy .... BS
Farris, Charles D., Box 4277, University .... SS
Feazel, C. E., Jr., Southern Research Institute, Birmingham C
Fenn, Hollis C., Rt. 1, Verbena .... SE
Fies, Milton H., Alabama Power Co., Birmingham .... IE
Fincher, J. A., Howard College, Birmingham .... BS
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Finn, Sidney B., University Med. Center, Birmingham .... MS
Fitzgerald, Richard W., 1805 Holly St., Montgomery .... BS
Fleming, Julius D., 328 Palisade Drive, Florence C
Floyd, H. H., Florence State College, Florence C
Foley, James O., 409 Sunset Drive, Vestavia, Birmingham .... MS

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Foster, Frank J., Box 2242, University ... FGC
Foster, Virginia, Judson College, Marion ... BS
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Francis, Robert D., University Med. Center, Birmingham ... MS
Francis, T. M., 334 Brown-Marx Bldg., Birmingham ... SS
Freymuth, John, P. O. Box 409, Jacksonville ... PM
Friedman, Louis L., 2528 Beverly Drive, Birmingham ... MS
Frisby, Carl E., API, Auburn ... IE
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Furman, Father W. L., Box 33, Gainesville, Fla. ... PM
Gandrud, B. W., 311 Caplewood Terrace, Tuscaloosa ... IE
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Garin, George I., API, Auburn ... FGC
Garren, Robert E., 118 S. Ross St., Auburn ... SS
Garrett, W. Walton, 4212 Overloog Drive, Birmingham ... IE
Garrett, W. Walton, 4212 Overlook Drive, Birmingham ... IE
Gary, C. M., Jacksonville State College, Jacksonville ... C
Gary, James H., Drawer H., University ... IE
Gayle, John B., Box L, University ... C
*Geisler, Edith, Hueytown High School, Bessemer ... SE
Gerhardt, Henry, 150 Hannon Ave., Mobile ... MS
**Gibbs, Billy, 118 Guntersville Rd., Arab ... PM
**Gill, Robert E., Jr., 444 5th St., West, Birmingham ... GA
*Gilmore, Vivian, Choctaw County High School, Butler ... SE
Glasgow, Richard D., 1405 Pineview Rd., Birmingham ... MS
**Glasscock, Mary Nell, Southern Research Institute, Birmingham ... BS
*Gober, Mrs. Gordon, Red Bay High School, Red Bay ... SE
Goethe, Charles M., (life), 720 Capital National Bank, Sacramento, Calif. ... BS
Goetz, James R., 2021 Sixth Ave. North, Birmingham ... IE
Goodrick, Ima J., 228 E. Glenn Ave., Auburn ... SS
Gordon, Kenneth M., Birmingham-Southern College, Birmingham ... C
Gorrie, Rachel H., 3155 Montezuma Rd., Montgomery ... BS
Gran, John Edward, 707 11th St., Tuscaloosa ... C
**Gray, Sidney F., 1412 13th St. South, Birmingham ... GA
**Gray, T. Randolph, 4700 Ave. T, Central Park, Birmingham ... GA
**Green, Betty, Daugette Hall, Jacksonville ... BS
Green, Margaret, University of Alabama, University ... MS
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Grimes, Harold W., API, Auburn .... FGC
Grove, E. L., Box H, University C
*Hafling, Mary E., West End High School,
1840 Pearson Ave., Birmingham .... SE
Hall, Clarence C., Jr., Howard College, Birmingham .... BS
Hammack, J. J., Livingston State College, Livingston C
*Hammond, Mary Ella, Sheffield High School, Sheffield .... SE
Hampe, David E., 200 Bonita Drive, Birmingham .... FGC
Hannum, Joshua E., 425 E. Magnolia Ave., Auburn .... IE
Hansen, A. T., Box 2982, University .... SS
Hanson, Roger W., University Med. Center, Birmingham .... MS
Hard, Herbert G., Jr., 120 Marvyn Rd., Opelika .... SE
Hare, Ruth S., 8944 Fourth Ave., South, B'ham. .... MS
Hargis, E. H., 1131 N. 28th St., Birmingham .... MS
Hargreaves, George W., 235 Woodfield Drive, Auburn C
*Hargrove, Geraldine, Tuscaloosa County High School,
2200 24th St., Northport .... SE
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Harrison, Gertrude C., Sacred Heart Academy, St. Bernard .... PM
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Hartwig, Chester W., 633 Sanders St., Auburn .... SS
Harvey, Henry T., 2317 Houston, Florence .... BS
Hastings, Earl, Geological Survey of Alabama, University .... GA
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Hays, Kirby L., API, Auburn .... BS
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Henry, J. D., Guaranty Savings and Life Insurance Co.,
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Herndon, Walter K., Box 2047, University .... BS
Hershey, Arthur L., Florence State College, Florence .... SS
Hess, George W., 10 Edgewood St., Selma .... PM
Hicks, Thomas I., Rt. 16, Box 265, Birmingham 9 .... PM
Hieserman, Clarence E., Chemstrand Corp., Decatur C
Hindle, Walter H., 1416 Beach St., Decatur .... IE
Hisey, Alan, Box H, University of Alabama, University .... MS
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Hites, Robert W., Birmingham-Southern College, Birmingham .... SS
Hitt, Nellie W., State College, Troy .... SE
Hobson, Patrick H., Chemstrand Corp., Decatur C
Hocking, George M., API, Auburn .... MS
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Hodgkins, Earl J., 533 Dumas Drive, Auburn .... FGC
Hogelin, Milford C., 3010 Circle Drive, Bessemer .... FGC
Holland, John W., Jr., Florence State College, Florence .... BS
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Holiman, Dan C., Box 1376, University .... BS
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**Howell, G. L., Box 5187, University .... BS
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Howse, B. C., Box 537, Fairfield ....
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Hunt, T. E., Med. College of Alabama, Birmingham .... MS
Hurtt, Oscar L., Jr., P. O. Drawer 2562, B'ham. C
Imhof, Thomas A., 307-38th St., Fairfield .... BS
*Ingle, James H., Talladega High School, Talladega .... SE
Irons, George V., 8143 Division Ave., Birmingham .... SS
Irvine, Paul, 425 N. College St., Auburn .... SS
Ivey, William D., API, Auburn .... BS
James, Perry B., Athens College, Athens .... SS
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**Johnson, Eugene F., Rt. 2, Jacksonville .... BS
Johnson, Robert B., 1518 S. 13th St., Birmingham C
Johnson, Searcy H., Jr., 432 Longview Drive, Vestavia Hills, Birmingham .... IE
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Jones, Walter B., University .... GA
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Kaylor, Hoyt M., Birmingham-Southern College, Birmingham .... PM
Kearley, Francis J., Jr., Spring Hill College, Mobile C
Keeler, James E., 3576 N. Georgetown Dr., Montgomery .... BS
**Keith, Barbara, 705 Clark Ave., N.E., Ft. Payne .... BS

Kilbourne, Dorwin L., 193 Bowden Drive, Auburn PM
Klapper, Clarence E., Med. College of Alabama, Birmingham MS
Klapper, Margaret S., Med. College of Alabama, B'ham. MS
Klontz, Harold E., API, Auburn SS
Knight, Vernon J., Coosa River Newsprint Co., Coosa Pines FGC
Kuderna, Jerome G., 157 Cary Drive, Auburn SE
Laffre, Randall O., Jr., 1364 Government St., Mobile 19
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Langley, Leroy L., Med. College of Alabama, Birmingham MS
Larguier, Everett, S. J., Spring Hill College, Mobile PM
Laster, William R., Jr., Southern Research
Institute, Birmingham 9 MS
**Lawrence, William L., Clayton GA
Lawson, J. Keith, Jr., Chemstrand Corp., Decatur C
Leibold, Armin, 350 Cary Dr., Rt. 1, Box 448, Auburn BS
Lenfesty, Franklin A., 148 Garfield Ave., Florence C
*Leonard, Lillian, Box 329, Bay Minette SE
Lewis, Arthur J., Crescent Hill, Selma SE
Lewis, F. A., Box 1444, University PM
Lindsay, Raymond H., 2813 Steiner Ave., Birmingham MS
Lindsey, Georgia I., Rt. 1, Elmore BS
Lindsey, Ralph H., 235 West Mountain, Jacksonville PM
Livingston, Knox W., API, Auburn FGC
*Lloyd, Lucille N., C. F. Vigor High School, Pritchard SE
*Lloyd, S. J., Department of Chemistry (honorary), University C
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Long, Pauline King, 4222 Fourth Ave. South, Birmingham BS
**Long, Thomas R., 440 12th St., West, Birmingham GA
Lueth, Francis X., Box 415, Centerville BS
Lyle, James A., API, Auburn BS
McCaffrey, J. E., International Paper Co., Mobile FGC
McCluer, Leon, Box 14, Jacksonville FGC
*McCluskey, Margaret, Minor High School, Birmingham SE
**McCollough, Alice Lois, 424 Judson St., Marion BS
McCollough, Ernest E., 424 Judson St., Marion C
McCracken, William Lionel, 2127 14th Ave., South,
Birmingham MS
McCullough, Herbert A.., Howard College, Birmingham BS
McCullough, John M., 2844 Span Place, Montgomery 7 FGC
McCurdy, G. L., Johnston Junior High School, Anniston SE
**McDonald, James M., 1220 8th Ave. West,
Apt. B-6, Birmingham GA

McGlamery, Winnie, Box O, University .... GA
**McKenna, Michael P., 1124 Montclair Rd., Birmingham .... GA
McKnight, Everett A., Woodward Iron Co., Woodward .... FGC
*McSpadden, Clyde J., Foley High School, Foley .... SE
McTyeire, Clustie Evelyn, 1804 Arlington Ave., Bessemer .... SE
McVay, Thomas N., 10 Oakwood Court, Tuscaloosa C
**Mahan, Stanley, Jr., Box 184, Montevallo .... BS
**Mahan, Mrs. S. M., Jr., Box 184, Montevallo .... BS
Mainland, Gordon B., State College, Jacksonville ....
Marshall, Hamilton L., 118 Florence Place, Mobile .... MS
Marshall, John David, P. O. Bob 409, Auburn .... SS
Martin, Billy O., Box 464, Florence C
*Martin, John S., Bessemer High School, Bessemer .... SE
May, Jack T., University of Georgia, Athens, Ga. .... FGC
Mayer, William C., Jr., 1467 Alford Ave., Birmingham C
Melius, Paul, API, Auburn C
Merkal, Richard S., Rt. 2, Box 20, Auburn C
Meyer, Freida L., 1410 Cloverdale Apts., Tuscaloosa .... BS
Miles, E. P., Jr., Florida State University, Tallahassee, Fla. .... PM
Miles, John B., Box 18, Mooresville .... PM
Miles, R. Vance, Jr., 1025 Myrtlewood Dr., Tuscaloosa .... FGC
Miller, Jesse E., 1107 S. 30th St., Birmingham .... FGC
Minton, Norman A., API, Auburn .... BS
Mitchell, F. H., Box 1392, University .... PM
Mobley, Willard M., Alabama By-Products Corp., Tarrant .... IE
Moffett, Benjamin C., University of Ala. Med. Center, B'ham. .... MS
Moore, O. C., API, Auburn C
Moore, William H., Room 1-G, State Office
Building, Knoxville, Tenn. .... FGC
Morehead, Beachley A., Chemstrand Corp., Decatur C
Morgan, Roy B., Chapman .... FGC
Morris, Bonnie, Rt. 1, Lanett .... SE
Morris, Ella D., Box 811, Mobile .... BS
Morris, Frederick K., 3334 Southmont Dr., Montgomery 6 .... GA
Mosley, Samuel A., Chemstrand Corp., Decatur C
Mulican, Charles Lee, Jr., 510 Comer Lane, Tallassee .... FGC
*Murphy, Ralph, Tuscaloosa Senior High, Tuscaloosa .... SE
Murray, Royce L., Alabama Power Co., Birmingham .... PM
**Murray, Mrs. Tom Ed, Rt. 2 Delta .... BS
**Nakane, Paul K., Huntingdon College, Montgomery .... BS
Nancarrow, Virginia, 617 St. Charles Ave., Birmingham .... BS
Nelson, Gid E., Jr., Alabama College, Montevallo .... BS

Nesbitt, Paul H., Chief, ADTIC, Research Studies
Institute, Maxwell AFB .... GA
Nichols, Samuel H., Jr., 130 Cary Dr., Auburn C
Nicholson, Catherine S., 944 Harding St., Jackson, Miss. .... BS
Oden, E. Clarence, Chemstrand Corp., Decatur C
O'Kelly, Joseph Charles, University of Alabama, University .... BS
Ottis, Kenneth, API, Auburn .... BS
Overton, Eleazer C., 2105 Warrior Road,
5-Points West, Birmingham .... MS
Padgett, Mrs. William H., API, Auburn .... BS
Paine, Thomas F., Jr., Univ. of Ala. Med. Center, B'ham. .... MS
Pallister, Hugh D., Geological Survey of Ala., University ....
Palmer, Geo. D., Jr., University C
Pankey, Paul, 2413 1st Ave. North, Birmingham .... IE
Parker, W. V., API, Auburn .... PM
Patton, Ernest Gibbes, Box 1927, University .... BS
Patton, Mrs. Francis M., Birmingham C
Paul, Edna, Bay Minette .... SE
Paulstain, E. C., Athens College, Athens .... SS
Peacock, J. Talmer, Box 2144, Texas A&M, Kingsville, Tex. .... BS
Pearsall, Marion, University of Alabama, University .... GA
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Pigman, Ward, Med. College of Alabama, Birmingham 5 .... MS
Pitman, Jean, 609 Elm St., Troy .... FGC
Pittman, Constance S., 1006 19th St. South, B'ham. .... MS
Pitts, Robert G., 216 Genelda Ave., Auburn .... PM
Poitras, Adrian W., API, Auburn .... BS
Poole, William L., 722 Woodward Bldg., Birmingham .... MS
Porter, Earl, 123 Florence Place, Mobile 17 .... FGC
Powell, P. P., 126 W. Glenn Ave., Auburn C
Powell, William F., U. S. Geological Survey, University ....
Powell, William S., Rt. 2, Attalla .... PM
Prather, Mary E., 420 Ash Ave., Ames, Iowa .... BS
Prestridge, Virginia W., 470 Samford Ave., Auburn .... IE
Price, Edwin O., API, Auburn C
Price, Emmett M., 1921 Lookout St., Mitchell Park, Gadsden .... MS
*Price, J. L., Robert E. Lee High School, Montgomery .... SE
Price, Leroy, Smith Ave, Elba .... PM
**Pritchett, Charlotte, 206 Jones St., Andalusia .... BS
Rau, William S., Rt. 4, Hanceville .... MS
Rawls, John L., Jr., 10-C Graves Apt., Auburn .... PM
Redmond, Howard R., Coker .... FGC
Reece, Orvil Y., 1304 E. 15th St., Tuscaloosa .... GA

Reeder, Charles, 1905 Windsor Ave., Montgomery .... PM
Reid, Mrs. Harry, Parrish High School, Selma .... SE
Reiner, Father Charles, St. Bernard College, St. Bernard .... SE
Reque, Paul G., 1927 First Ave. North, Birmingham .... MS
Reynolds, William B., 1514 S. 15th St., Birmingham C
Rhein, Walter J., Spring Hill College, Mobile .... PM
Richards, D. B., API, Auburn .... FGC
Richardson, Jesse M., API, Auburn .... FGC
Riggsby, Ernest D., Box 425, Troy State College, Troy .... SE
Ringwold, Eugene L., 1302 Morningside Court, Decatur C
Rives, DeLeath, Oak St., Albertville .... BS
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Roberts, Bruno R., Box 1503, Decatur C
Robertson, Robert L., API, Auburn .... BS
Robinson, True W., Med. College of Ala., Birmingham .... MS
Rodgers, Eric, Box 1472, Tuscaloosa .... PM
Roger, Wiley S., Birmingham-Southern College, Birmingham .... GA
Rosen, Lawrence, School of Medicine, Duke University, Durham, N. C. .... MS
*Ruf, Hazel, Athens High School, Athens .... SE
Rupert, Rodney H., Siluria Clinic, Siluria .... MS
Rust, Henry B., The Rust Engineering Co., Birmingham .... IE
**Sallas, James, Pannell Hall, Jacksonville .... BS
Salmon, W. D., API, Auburn .... MS
Sanders, Robert H., 296 Chewacla Drive, Auburn .... SS
Sanford, Thomas H., Jr., 526 Bonita Circle, Huntsville .... GA
Sansing, Norman G., API, Auburn .... BS
Saunders, Charles R., 369 Payne St., Auburn C
Schneyer, Leon D., School of Dentistry, University Medical Center, Birmingham .... MS
Schwartz, Ferdinand F., 916 South 20th St., Birmingham .... MS
Scott, Louis D., Chemstrand Corp., Decatur .... IE
Scott, Robert B., Jr., University of Alabama, University C
Searcy, Margaret Z., 1715 4th St., Tuscaloosa .... SS
Seibold, Herman R., Box 671, Greenpoint, Long Island, N.Y. .... MS
Sellars, Edwin M., Baggett Trans. Co., Inc., B'ham. .... IE
Sellars, William D., Baggett Trans. Co., Inc., B'ham. C
Sensenig, E., Carl, Medical College of Alabama, B'ham. .... MS
Sevier, Sister Mary Susan, Sacred Heart Academy, Cullman .... PM
Sharp, C. G., Alabama College, Montevallo .... GA
Shelton, William H., Box 2082, University .... SS

Shoffeitt, Paul E., 759 Samford Ave., Auburn MS
Shotts, Reynold Q., 8 Forest Lake, Tuscaloosa GA
Shull, Barney L., Box 609, Fairhope BS
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Simpson, Thomas A., U.S. Geological Survey,
Room 302, City Hall, Bessemer GA
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Sizemore, Julian J., 2251 Highland Ave., Birmingham MS
Sizemore, W. R., Box 244, Tallassee FGC
Smalley, Glendon W., Sr., 4748 Ave. W., Ensley, Birmingham FGC
Smith, Anthony J., 710 Prospect, Florence C
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Smith, Donald F., Box H, University IE
Smith, E. V., Comer Hall, API, Auburn BS
Smith, Frank F., Rt. 1, Box 187-A, Loxley FGC
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Smith, Septima C., Box 1446, University BS
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Sowell, Inez G., 6-B Hare Apt., Auburn SS
Spann, Ransom Davis, 314 E. Thach, Auburn PM
Speake, Dan W., 1010 E. Glenn, Auburn FGC
Spencer, G. O., Troy State College, Troy PM
Spencer, Lilly H., API, Auburn SS
Spidle, Marion W., 306 Cary Drive, Auburn SS
Spies, Tom D., (life) Hillman Hospital, Birmingham MS
Spieth, Alda May, Livingston State College, Livingston BS
**Standridge, Yvonne, Daugette Hall, Jacksonville BS
Stauffer, Jacob M., No. 32 Arlington Road, Montgomery 6 FGC
Steele, H. Ellsworth, API, Auburn SS
Stelzenmuller, J. G., 412 S.W. 12th St., Birmingham IE
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Stevens, Frank J., API, Auburn C
Stewart, Mary Elizabeth, Box 313-A, Marion BS
Stickney, Hazel L., Livingston State College, Livingston FGC
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Sullivan, John L., Box 276, Birmingham .... IE
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Summersell, Charles G., Box 1936, University .... SS
Tankersley, Richard S., Rt. 3, Alexander City .... BS
Tarbutton, Grady, 111 Village 1, Sheffield C
Tate, John M., Box 344, Arab C
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Medical Center, Birmingham .... MS
Thompson, Davis Hunt, 917 Valley Rd. Place, Birmingham C
Thompson, Georgia J., Station 3, Bryce Hos., Tuscaloosa .... MS
Thompson, H. Leroy, 329 Brown-Marx Bldg., B'ham. .... IE
Thompson, Margene G., 353 Park Ave., Shades Mt.,
Birmingham 9 .... SE
Thompson, Woodford R., Jr., Jennings, Carter and
Thompson, Title Building, Birmingham C
Thompson, Wynelle D., 917 Valley Rd. Place, Birmingham C
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College, Birmingham .... FGC
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Turner, Henry F., API, Auburn .... BS
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Ucci, Pompelio A., Chemstrand Corp., Decatur C
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Unger, Gus, Pannell Hall, Jacksonville C
Unnewehr, E. C., Athens College, Athens .... PM
Valentine, Claude E., Spring Hill College, Mobile .... SE
Van de Mark, Mildred, API, Auburn .... BS
Veasey, Thomas M., 2026 Woodland, SE, Decatur C
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Volker, Joseph F., University of Alabama School of
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Weigel, Robert D., Howard College, Birmingham .... BS
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**Welch, Sue, Daugette Hall, Jacksonville .... BS
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